AUTOMOTIVE INDUSTRIES

MARCH 1, 1953

AUTOMOTIVE and AVIATION MANUFACTURING
CIVILIAN AND DEFENSE
ENGINEERING • PRODUCTION • MANAGEMENT

In This Issue . . . Another Important Automation Application · · · · Effects of Piston Pin Offset · · · · Monroe Power Steering · · · · Reinforced Plastics Analyzed · · · · New Powerglide Valving · · · Cold Heading Tappets

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A CHILTON PUBLICATION

STANOSTAMP
REG. U. S. PAT. OFF.
Compounds

Easy on the draw

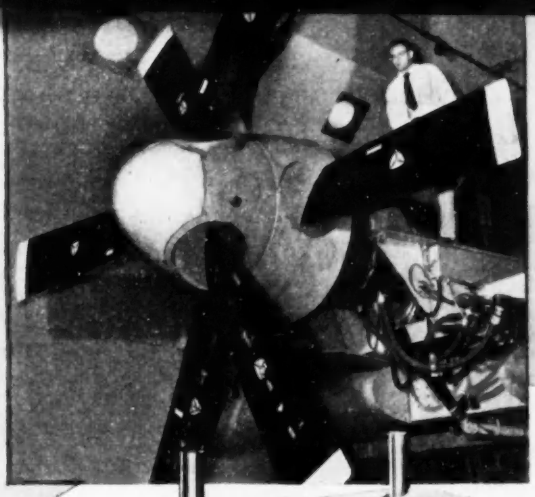
• Shown above is the drawing operation used by the Lock Joint Tube Co., South Bend, Indiana, in the production of automobile steering gear jackets. Two ¼-inch draws are made on steel tubing.

Dissatisfied with the performance of a conventional drawing compound on this job, operators took the advice of a Standard Oil lubrication specialist and switched to STANOSTAMP C Compound.

This product has met their needs on every count. It has proved economical to use because operators have been able to mix it with water and soluble oil and apply that mixture in light coatings to the steel tubing. STANOSTAMP C has provided better protection for dies, thus reducing wear. Draws are now made on over 2,000 pieces before dies require polishing. Although the drawn pieces are not cleaned until long after the drawing operation, there have been no rusting troubles.

Whatever your problem or need, you'll find as did this midwest company that a Standard Oil lubrication specialist can help you. He has a complete line of high quality cutting oils to offer and the training and practical experience to apply them most effectively. You can get his help quickly and easily by phoning your local Standard Oil Company (Indiana) office. Or write: Standard Oil Company, 910 South Michigan Ave., Chicago 80, Illinois.

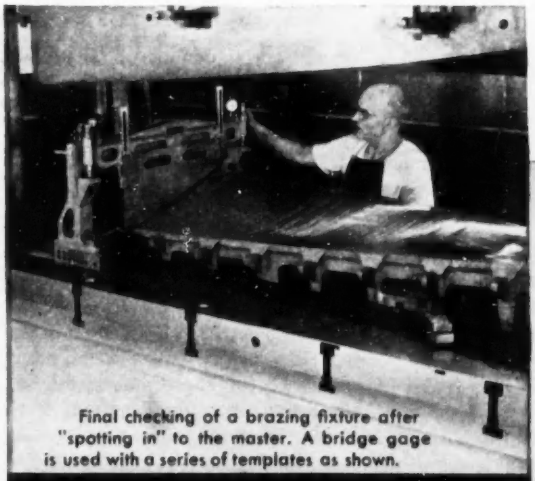
STANDARD OIL COMPANY STANDARD *(Indiana)*



High speed aircraft propeller on test stand—built from tools "spotted in" in a DANLY SPECIAL DIE SET.

DANLY SPECIAL DIE SET, 46 by 140 inches, used for both production and checking of aircraft propeller tools.

DANLY SPECIAL DIE SETS



Final checking of a brazing fixture after "spotting in" to the master. A bridge gage is used with a series of templates as shown.

DEPENDABLE FOR ACCURACY

Here's proof . . . this Danly Special Die Set is used by one of the country's leading aircraft propeller manufacturers for "spotting in" all contour tools for a complete production line. Accuracy is a must because the tools, masters for duplicating planers and profilers as well as holding fixtures, must mate closely with the master pattern and with each other in the sequence of operations.

Dependable accuracy makes Danly Special Die Sets ideal for applications of this kind . . . and rugged construction makes them last longer, too, on any job. That's why leading diemakers everywhere prefer Danly Die Sets!

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue • Chicago 50, Illinois

DANLY

DIE SETS AND DIEMAKERS' SUPPLIES

DANLY SPECIAL DIE SET SERVICE IS FAST AND CONVENIENT—CALL YOUR NEAREST DANLY BRANCH

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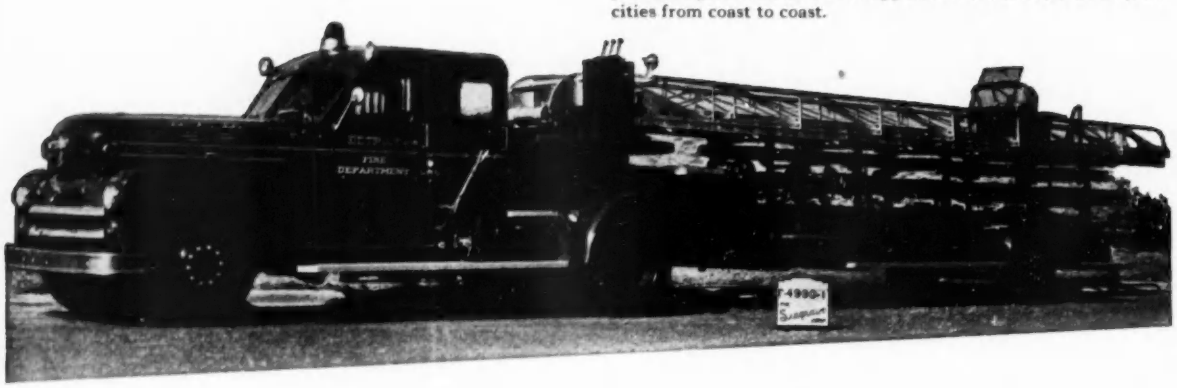
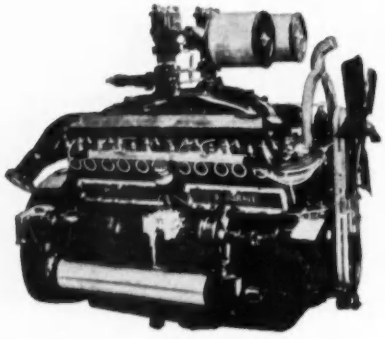
*DAYTON	7	3196 Delphos Avenue
*DETROIT	16	1549 Temple Avenue
*GRAND RAPIDS		113 Michigan Street N.W.
INDIANAPOLIS	4	5 West 10th Street
*LONG ISLAND CITY	1	47-28 37th Street
*LOS ANGELES	54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE	2	111 East Wisconsin Avenue
*PHILADELPHIA	40	511 W. Courtland Street
*ROCHESTER	6	33 Rutter Street

*Indicates complete stock

NICKEL-CONTAINING ALLOYS CONTRIBUTE to the dependability of SEAGRAVE Fire Apparatus used in more than 3,000 cities from coast to coast.



How Nickel helps SEAGRAVE



add strength and safety...

cut bulk and deadweight...

minimize maintenance

Built in the SEAGRAVE factory, especially for fire service, this precision built V-12 engine utilizes nickel alloyed iron blocks, heads and pistons produced by ALLYNE-RYAN FOUNDRY CO., Cleveland, Ohio.

This aerial ladder truck — *the entire apparatus, including frame, engine, pumps, controls* — exemplifies the type of complete product made by THE SEAGRAVE CORPORATION of Columbus, Ohio.

With no need of surplus bulk for strength, nickel alloyed bronzes enable SEAGRAVE to produce fine-grained, pressure-tight, machinable castings not only for fittings and small vane type pumps that operate ladders, but also for cast parts in their heavy duty, 4-stage pumps that raise water pressures up to 1000 p.s.i.

Engine castings, including blocks, heads and cylinders are specified in nickel alloyed cast iron to obtain strength and wear-resistance along with machinability in all sections, thick or thin.

Metal ladders and water tanks are fabricated from a low alloy high strength steel containing nickel, to obtain maximum weight reduction in these components without sacrificing strength or safety. Nickel alloyed steel of this type, produced under various trade names by leading steel companies, is used in strip form for ladders, and in sheets for the tanks.

And the unexcelled mechanical properties of case hardened nickel alloyed steel components in Timken rear axle units, complete with brake drums, contribute power-saving capacity to SEAGRAVE apparatus.

Nickel-containing alloys offer significant advantages wherever safety and dependability are essential. When you face a metal problem, send us the details for our suggestions.

At the present time, nickel is available for end uses in defense and defense supporting industries. The remainder of the supply is available for some civilian applications and governmental stockpiling.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

A CHILTON MAGAZINE AI PUBLISHED SEMI-MONTHLY

AUTOMOTIVE INDUSTRIES

MARCH, 1, 1953 VOL. 108, NO. 5

CONTENTS

FEATURES

NEWS PREVIEWS

DEPARTMENTS

AUTOMOTIVE INDUSTRIES is a consolidation of The Automobile (weekly) and the Motor Review (weekly) May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

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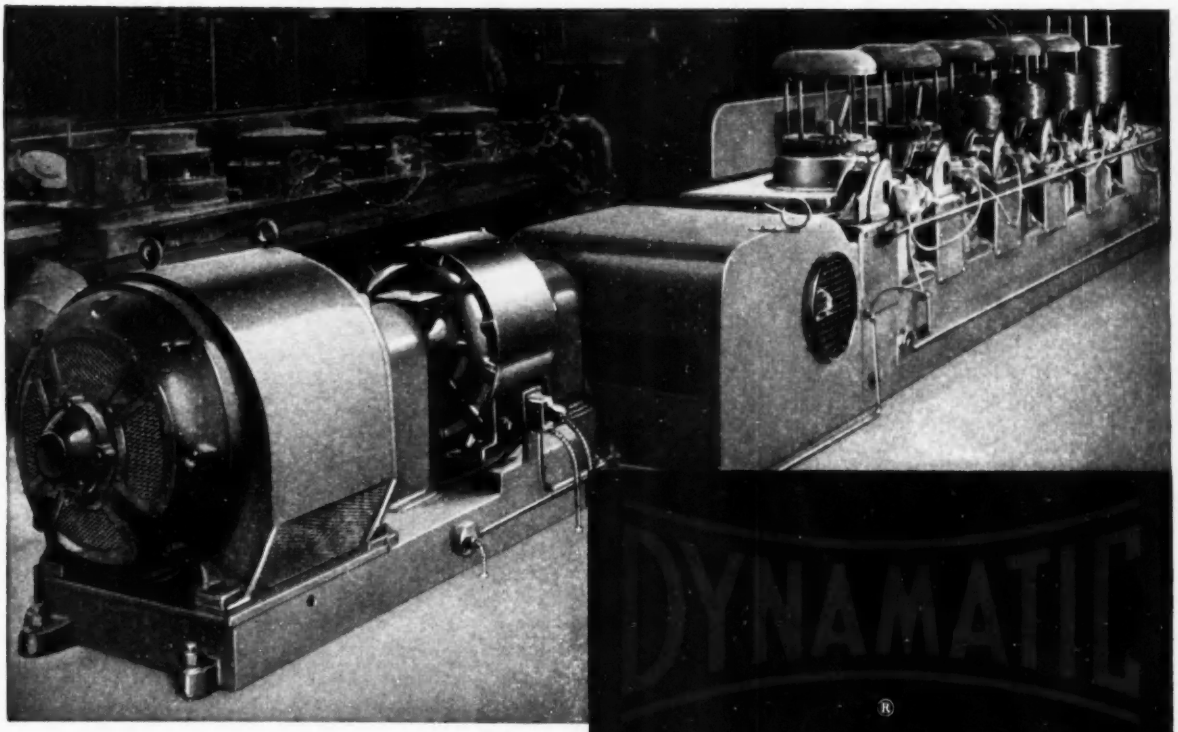


Model 7W Dynamatic Water-Cooled Coupling driving a wire machine which draws 7/32" wire to .070" in six dies. Power is derived from a 200 HP, 1200 RPM induction motor.

DYNAMATIC®

WATER-COOLED POWER COUPLINGS

Adjustable Speed Drives for Industrial Use

Dynamatic Water-Cooled Couplings provide adjustable speed drive direct from an AC power source for a wide range of industrial applications. They transmit rotation from a driving to a driven member without mechanical contact with stepless adjustable control and almost instantaneous response. A simple method of providing adjustable speed from a constant speed source (or vice versa) with full torque starts.

Effective water-in-the-gap cooling permits large capacity in small space; design provides complete protection against atmospheric impurities.

Standard sizes are available for transmitting torques of 50 pounds feet to approximately 5,000 pounds feet. Units up to 200,000 pounds feet or larger can be built to order.

Write for Illustrated Booklet WC-1

WIDE SPEED RANGE

INSTANTANEOUS RESPONSE

ACCURATE SPEED CONTROL

STEPLESS SPEED ADJUSTMENT

SMOOTH TORQUE TRANSMISSION

TOTALLY ENCLOSED

SIMPLE • QUIET

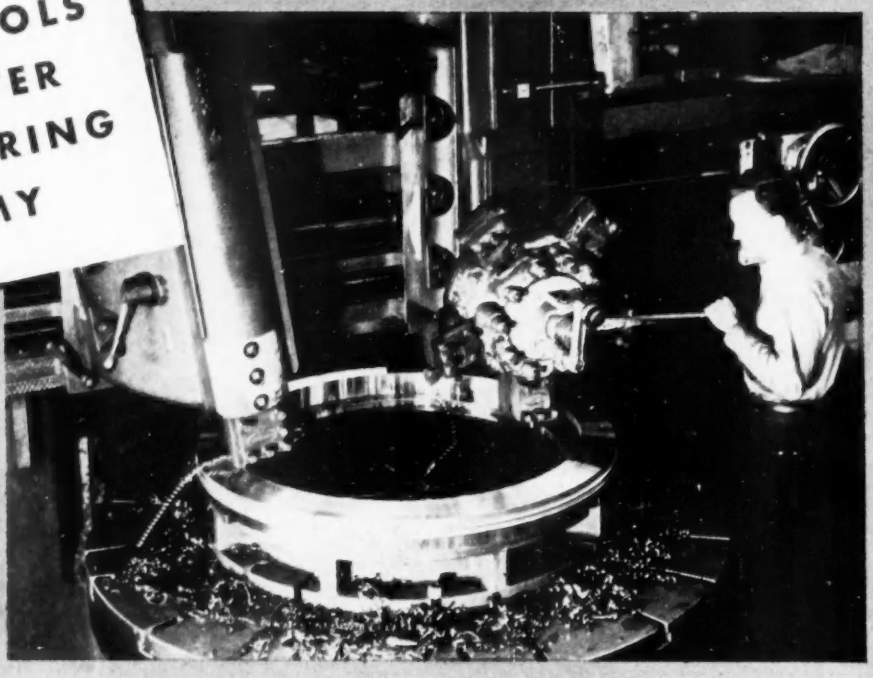
COMPACT • EFFICIENT

DYNAMATIC® **CORPORATION** • **KENOSHA WISCONSIN**

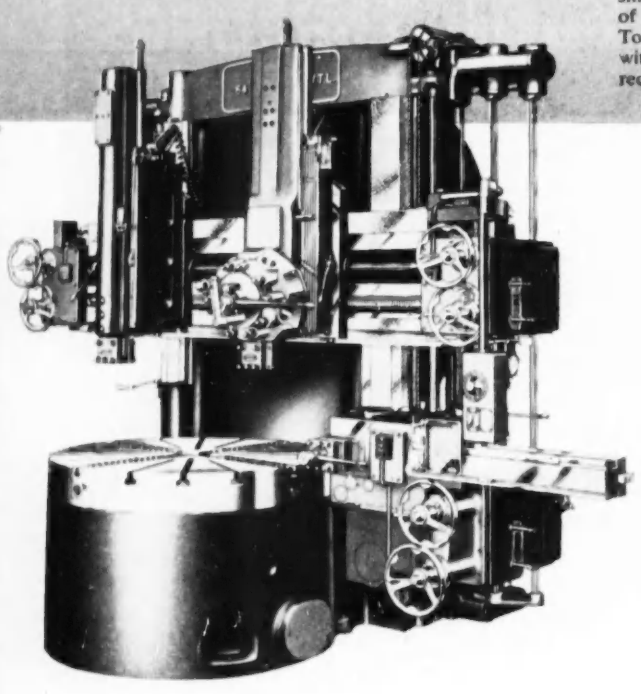
Subsidiary of **EATON MANUFACTURING COMPANY,** Cleveland, Ohio

Dynamometers • Oil Well Draw-Works Brakes • Adjustable-Speed Couplings • Eddy-Current Brakes
Ajusto-Spedes • Shovel Clutches • Press Drives • Lift Truck Clutches • Electronic Controls

BULLARD MACHINE TOOLS FOR GREATER MANUFACTURING ECONOMY



In the background of "Industrial Progress" lies the development of the name Vertical Turret Lathe. This name, an offshoot from the old single-head boring machine, was established in 1909 by the inception of a vertical boring mill having a sidehead, which Bullard pioneered. Today the modern conception is the Cut Master Vertical Turret Lathe with its design and engineering in keeping with manufacturing requirements.



The Cut Master is exactly, in all respects, what its name implies — accurate and efficiently productive. Truly a machine for manufacturing economy. These machines are widely reputed to be of great adaptability on almost all classes of work. Bullard Machines of this type, because of their wide range of sizes, are ideally suited for installation aboard many of the United States ships of defense for their maintenance requirements. Furthermore, Bullard Machines are used in the industries which manufacture for the large construction projects where the accuracy of the finished product determines its reliability for the functions required. Original machining accuracy of work assures reliability with minimum maintenance costs over long periods. Bullard Cut Master Vertical Turret Lathes give assurance to your customer that the product bearing your name is of the highest quality.

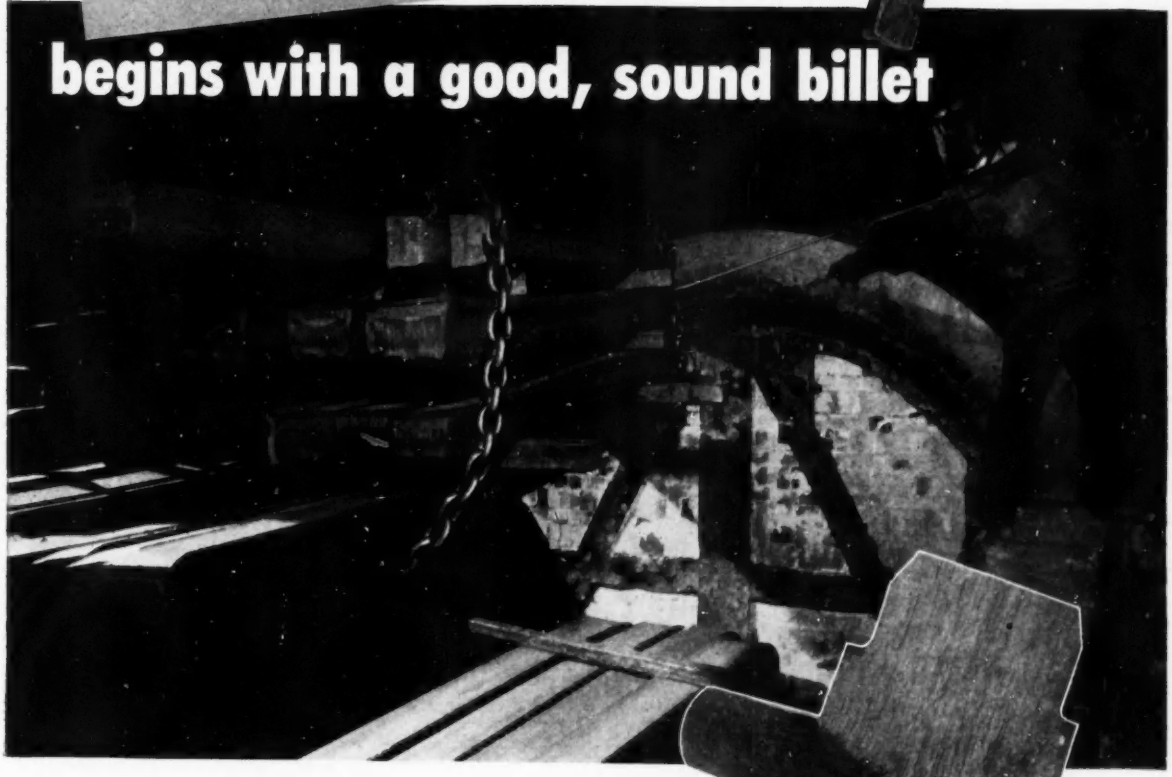
BULLARD

Time saved is money earned. Write now for information.

THE BULLARD COMPANY BRIDGEPORT 2, CONNECTICUT

Successful Forging

begins with a good, sound billet



At Bethlehem we take unusual care in producing alloy steels for forging purposes.

Chemical composition and grain size are closely controlled so that the forgings will respond to heat-treatment uniformly with minimum distortion. Billets are cooled slowly in bung-type furnaces, with separate cooling cycles being used for each composition, to avoid cooling cracks. Rolled billets are subjected to macro-etch tests to insure internal soundness. Nothing is overlooked that might improve the overall quality.

Bethlehem Alloy Steels will go a long way toward helping you turn out a higher percentage of acceptable forgings. We manufacture all of the AISI grades, as well as carbon and special steels.

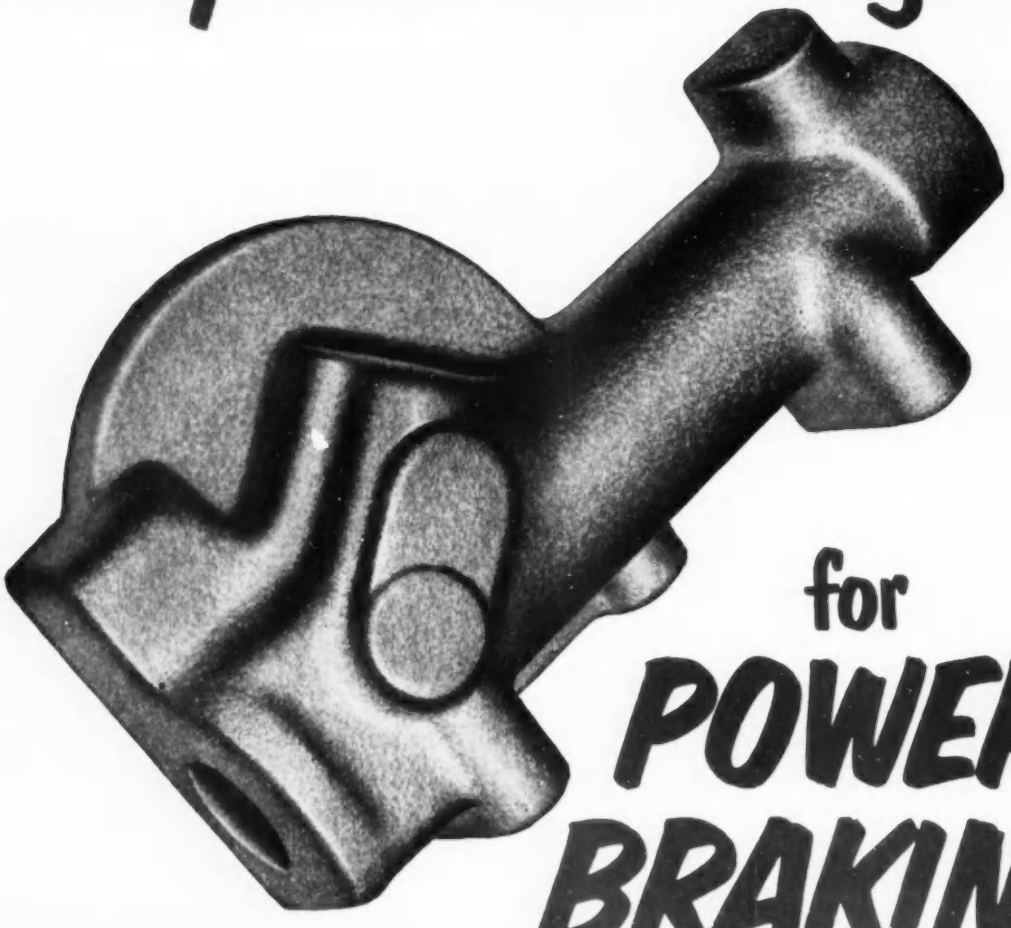
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM ALLOY STEELS

Eaton Permanent Mold Gray Iron Castings—



for POWER BRAKING

Send for your free copy of the 32-page illustrated booklet: "The Eaton Permanent Mold Foundry." It tells the story of Permanent Mold Castings and takes you on a picture-tour of the Eaton Foundry at Vassar, Michigan.

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General Offices: CLEVELAND, OHIO
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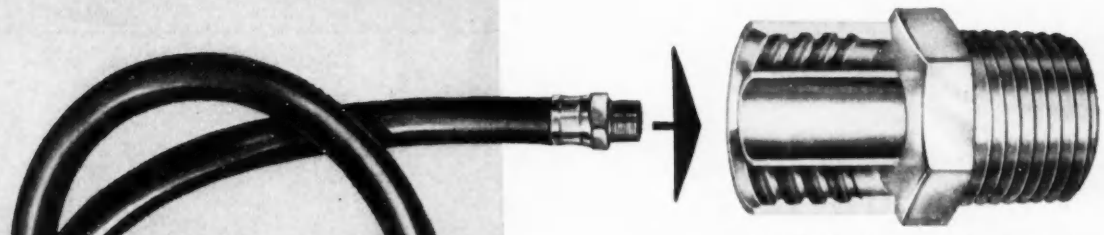
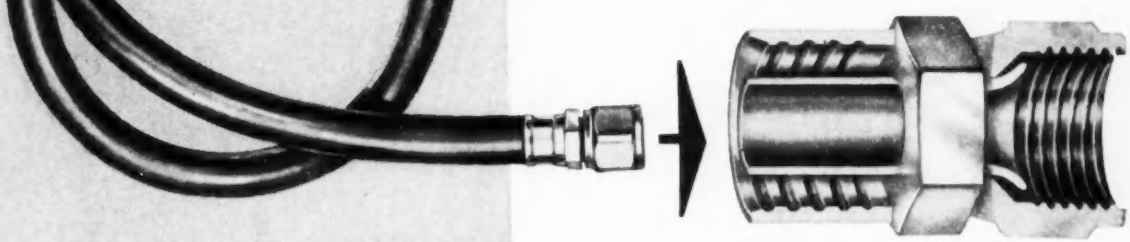
PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers



Flex-o-Tube Hose, and cross section of machined male fitting.

FLEX-O-TUBE ...finds brass makes fine fittings



Cross Section of machined and flared female fitting.

For quick, accurate and economical machining, free-cutting brass rod is preferred by many companies, such as Flex-O-Tube, Division of Meridan Corporation, Detroit, Mich. This company makes hose assemblies and fittings to conduct air-oil-water-gasoline and hydraulic power for the automotive, farm implement, machine tool and aircraft industries. Some of these hoses have a minimum bursting pressure of 20,000 pounds per square inch, which gives an indication of the tightness required, which can be obtained only by strength and accuracy.

Flex-O-Tube has found six points of superiority for brass over other metals, as follows:

1. Brass "flows," or is ductile, so that no cracks result during the crimping operation required to fasten the fittings to the hose.

2. Ductility and strength inherent in brass act to provide a superior seat to fittings designed to control fluid flow. Competitive metals are either too hard or too soft to give positive closing and tend to leak.

3. Where the design of the fitting is intricate, necessitating removal of considerable metal by machining, the automatic screw machines can be run faster with free-cutting brass rod.

4. Brass has a high scrap value, and the scrap sold back to the mill increases brass supplies.

5. The break-even point between brass and other metals is especially favorable to brass in the sizes of rod that Flex-O-Tube buys.

6. Customer preference is for brass, which is universally recognized as a quality metal. Hence brass fittings are more readily sold, and in fact often are specified regardless of size or price differentials.

Included in the Flex-O-Tube operations are machining, flaring, crimping, and annealing to assure the proper ductility for flaring and crimping.

Revere is an important supplier of brass rod to Flex-O-Tube, and has also collaborated with this customer through the Revere Technical Advisory Service.

If you wish information about brass and how one or more of the Revere brasses can add to the economy and saleability of your product, get in touch with the nearest Revere Sales Office. See your telephone directory or write direct.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

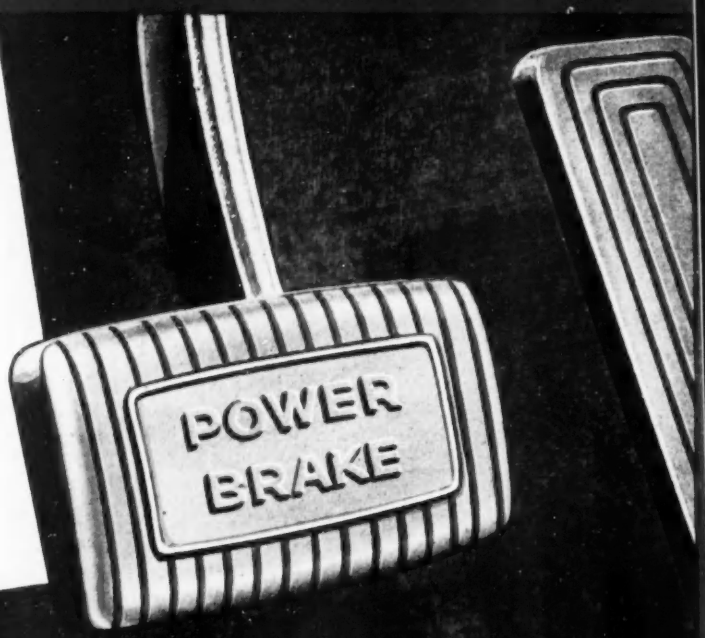
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities. Distributors Everywhere.

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

Bendix leads again...

with

the only performance proven LOW PEDAL power brake



The Greatest Improvement in Braking Since Four Wheel Brakes

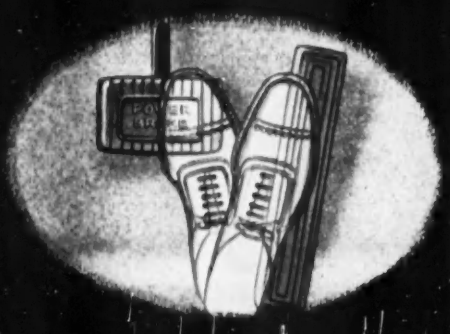
One of the most popular new car features offered the public in years is the performance proven **low pedal power brake** engineered and manufactured by Bendix, the industry's leader in all types of braking.

The Bendix* low pedal power brake represents an entirely new conception of power braking designed specifically to meet the braking requirements of the industry's latest and finest vehicles.

This great advancement in braking is unique in many ways. It is, for example, the **only low pedal power brake** that has met the tests of millions of miles under all operating conditions. It has already won the overwhelming preference in its field with car manufacturers. And this low pedal power brake is the product of Bendix, the world's largest producer of power brakes and the originator of practically every important braking development since the earliest days of the automotive industry.

Passenger car manufacturers contemplating power braking should investigate the advantages of the Bendix low pedal power brake. *REG. U.S. PAT. OFF.

NOW *Stopping* IS AS EASY AS *starting*



It is no longer necessary to lift the foot and exert leg power pressure to bring your car to a stop. With the Bendix Low Pedal Power Brake on about the same level as the accelerator, an easy ankle movement, much like working the accelerator is all the physical effort required for braking. And by merely pivoting the foot on the heel, shifts from "go" to "stop" controls are made in far less time.

Result: More driving comfort, less fatigue and greater safety.

Bendix Products Division

BENDIX PRODUCTS DIVISION SOUTH BEND Bendix AVIATION CORPORATION

Export Sales: Bendix International Division, 72 Fifth Ave., New York 11, N. Y. • Canadian Sales: Bendix-Eclipse of Canada, Ltd., Windsor, Ontario, Canada

MOST TRUSTED NAME IN BRAKING

AUTOMOTIVE INDUSTRIES

High Spots of This Issue

★ **Valve Mechanism of the 1953 Powerglide Transmission**

Featuring several changes in its 1953 version, Chevrolet's Powerglide automatic transmission now provides Drive with a low and cruising range. This and other features of its operation are described and pictured here. See Page 24.

★ **Effects of Piston Pin Offset**

Piston slap in engines has always been a somewhat bewildering phenomenon to the automotive engineering world. The author of this article discusses factors which cause trouble and outlines a setup for analyzing actual piston action. Page 28.

★ **Materials Handling Automation in Buick V-8 Production**

A logical sequel to a previous piece on the new Buick engine plant (see AUTOMOTIVE INDUSTRIES, February 1, 1953), this story covers the conveyor and other materials handling systems. More operations on the engine are covered also. Page 32.

★ **An Aircraft Designer Analyzes Reinforced Plastics**

Sorely needed by the aircraft industry is a new material to fulfill planned design parameters demanded by high production and temperature requirements. The answer may lie in some plastic material, whose adaptation is described. Page 38.

★ **Possibilities for Weight Reduction in Trucks**

Ways to slough off poundage are as eagerly sought after by truck manufacturers as they are by members of the fair sex. This vital topic, along with power hydraulics and research methods, highlighted a recent SAE meeting. Page 44.

★ **19 New Product Items**
And Other High Spots, Such As:

Steel valve tappets made by cold heading; lightweight foamed plastic strengthens aircraft components; ductile iron applications expand; Monroe power steering in production; and new small Diesel engine powers Fiat truck and bus.

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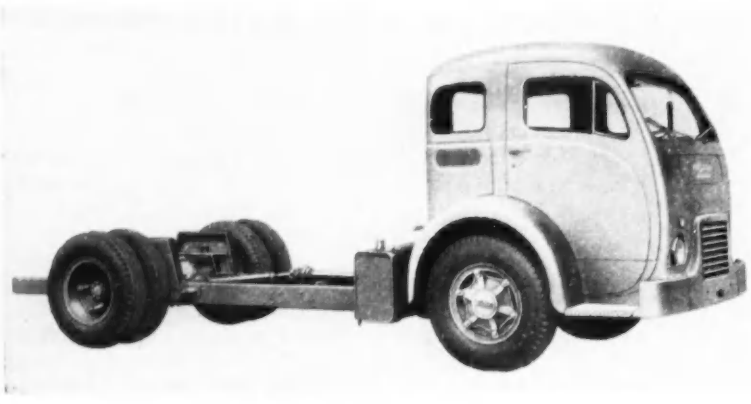
News of the AUTOMOTIVE



WHITE ANNOUNCES LOWBOY

Latest addition to the White 3000 series is this low-bed frame model. The new frame drops the body 12 in. below conventional models for greater capacity, and comes in 111 and 147 in. wheelbase for delivery service of all kinds.

NLRB Rules on Five-Year Contracts

Automobile industry workers covered by five-year contracts are barred from union representation elections while the agreements are in effect, the National Labor Relations Board has ruled. Importance of the ruling lies in the fact that it's the first time the NLRB has held that a contract may bar an election for longer than three years. About 537,500 auto workers are covered by the five-year contracts.

Effect of the decision is to reverse an earlier ruling that held long-term contracts to be a bar to an election only when it was proved that such contracts were the custom in the industry. Actually, the NLRB refused petitions for elections in four plants: General Motors Corp. Detroit Transmission plant; AC Spark Plug plant at Milwaukee; Bendix Parts plant at South Bend, Ind.; and the West Allis, Wis., plant of Allis Chalmers.

Buick, Fisher Share Dual Purpose Plant

A dual purpose plant located 20 miles southwest of Chicago, Ill., will soon be opened by General Motors Corp. Approximately half of the plant will be used by Fisher Body Div. for production of automotive stampings, with the balance of the plant occupied by Buick and devoted to its jet engine program.

The new plant is on a 250-acre site and contains 1.48 million sq ft of floor space, of which 1.22 million sq ft is devoted to manufacturing. The Fisher operation will serve as a source of supply of stampings for all GM assembly plants, and will consist of two major departments, one for output of large stamping dies and tools, and the other devoted to producing a complete line of panels, roofs, and other metal parts used in body building.

A battery of 240 presses will be used to stamp out the metal parts in the large press area. The plant is laid out in a continuous flow design, with steel and other raw materials arriving at one end of the plant, and progressing through blanking and shearing machines directly to press production lines and sub-assembly operations from where they are routed to the shipping section. Fisher expects to employ nearly 4000 workers when the plant is completed and is operating at capacity.

Tinted Glass Popular

Tinted glass in automobiles is becoming increasingly popular, even in the lower priced field. Plymouth reports that currently about 40 per cent of orders received from dealers specify the shaded glass all around.

New Car Sales Totaled 4,158,394 Last Year

Latest official tabulation on new car sales last year compiled by R. L. Polk & Co. shows new car registrations for 1952 totaled 4,158,394 passenger cars. The total for 1952 was 902,509, or 21.4 per cent, under the previous year, approximately equivalent to the drop in production between the two years.

New truck registrations last year totaled 812,099 units, the lowest since 1946. Registrations last year were down 19.1 per cent below 1951, a drop somewhat greater percentagewise than occurred in production, which was about 14 per cent below the previous year. However, some of the difference between the two percentage declines can be accounted for by the increase in exports last year.

Ford to Double Dallas Output

Ford Motor Co. is adding an extra shift to its assembly plant operations at Dallas, Tex., and by early April will double current production of cars and trucks. Production space recently was doubled when a two-story addition to the plant was completed. Between 800 and 1000 new employes will be hired for the extra shift to increase output at the plant, which serves 570 dealerships in the Southwest.

Site for the West Coast assembly plant recently announced is reported to be at San Jose, Calif. A 160-acre plot is said to have been selected on which construction will start immediately.

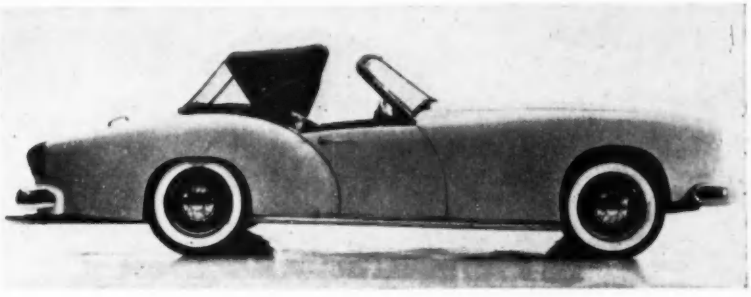
Nash Surveys Dealers

Nash has joined the growing list of companies who are turning to their dealers for product preference information and customers' reaction to certain models and optional equipment. The company has completed a dealer opinion survey and the tabulations received throughout the country on percentage of models and optional equipment desired are being incorporated into production schedules and distribution procedures.

AND AVIATION INDUSTRIES

Credit Curb Revival Talk Alarms Car Dealers

Automobile dealers and some manufacturers have had cold chills as a result of reports that the Eisenhower administration is considering a possible revival of regulation "W," the curb on consumer credit. Apparently some of the President's advisers are concerned over the increase in outstanding consumer credit and think that inflation might be slowed by reimposing regulation "W." Other advisers, however, point out that while outstanding credit is at a high point, it represents no greater percentage of total national income than it did pre-war.



K-F SPORTS CAR—LATEST VERSION

A three-position folding top is a feature of the DKF-161, Kaiser-Frazer's sports model scheduled for production in July. Height with top up will be 54 in. Fiberglas-reinforced plastic body shell will weigh 300 lb. and road weight will be just over 2000 lb.

Employment at Peak

Employment in the automobile industry rose to the highest point in history during January, even surpassing the previous high set in March, 1951. According to AMA, total workers employed in motor vehicles and parts plants during January stood at 940,000, exceeding the previous high of 936,000 set two years ago by 4000. The highest employment point during World War II was established in January 1944, when it stood at 827,000 workers.

Employment in all operations is even higher than the 940,000 indicated, as this figure covers only plants classified as motor vehicle and parts plants. When employment at new plants in the industry devoted exclusively to defense work are included, such as the Chrysler Delaware tank plant and the new Ford tank plant at Livonia, Mich., the total is substantially higher. However, these employment figures are classified.

Willys Disclaims Tie with "Wildfire" Car

Willys-Overland Motors, Inc., has issued a clarification statement concerning its connection with the sports car, the "Wildfire," which is built on a Willys chassis. The company points out that contrary to some general opinion, the Wildfire is not a product of Willys, and the company is in no way the car's sponsor. The Wildfire has a modified Willys chassis, is powered by a Willys engine, and features a body of fiberglass construction. The misconception of the Willys sponsorship arises in part from the showing of the car at the Willys Golden Jubilee Dealer Day Convention in Toledo in December. However, it was brought in by a former West Coast dealer interested in the car, and does not represent a future Willys model.

C.I.O.-Communist Attitude Accord Seen in Study

A comprehensive study of C.I.O. and communist attitudes toward the American free enterprise system has just been completed for the Timken Roller Bearing Co.

The study reveals the coincidence of these attitudes, as established by official publications of both groups, testimony before congressional and other hearings, and other sources. In almost every instance where some aspect of the free enterprise system is involved, the survey shows how the official C.I.O. line, sometimes even to the wording, followed the Communist party line as persistently as a shadow.

Copies of the survey are now being prepared and may be obtained at cost from John Yezbak & Co., 3214 Prospect Ave., Cleveland 15, O.

1952 Vehicle Exports Showed Small Drop

Motor vehicle exports last year declined about one per cent below the previous year, a much smaller drop than for domestic sales. Official figures released by AMA for 1952 show that U. S. companies sold 5,538,547 vehicles last year, a reduction of more than 18 per cent below the previous year. Of this number 329,572 were sold abroad and represented a little less than six per cent of total sales. During 1951, export sales accounted for more than 470,000 units representing about seven per cent of total vehicle output. The breakdown of factory sales for last year shows 4,320,788 passenger cars, 1,212,390 trucks, and 5369 motor coaches. The 5,538,547 vehicles sold last year compares with 6,765,263 units sold in 1951.

Small Car to Have Automatic Drive

With adoption of an automatic drive by Plymouth, about the only passenger cars not now offering this type of driving device are the smaller cars in the Ford-Chevrolet-Plymouth price range, such as the Nash Rambler, Henry J, and Willys Aero. However, even this field will be invaded soon when one of these companies will announce an automatic drive as optional equipment.

News of the AUTOMOTIVE

SOUND TEST WITH TWO EARS

Binaural technique in road-testing a body for sound gives the same effect to the ear as stero vision does to the eye. Fisher Body Div. uses two microphones set in position corresponding to the human ear to record on a two-channel tape recorder. Playback in the laboratory uses one earphone for each channel, for comparisons of soundproofing effectiveness.

National Lead Absorbs Doehler-Jarvis Corp.

Stockholders of Doehler - Jarvis Corp. of Grand Rapids, Mich., have approved the sale of all assets to National Lead Co. and dissolution of the corporation. Doehler-Jarvis stockholders will receive 1-15/100 shares of National Lead common for each share of Doehler-Jarvis. D-J operates nine plants and has about 8500 employes.

New Die Metal

According to a recent report, General Motors Overseas has been using for some time a new zinc alloy developed by GM research laboratories for making long-wearing short run dies. Known as Gmoodie metal, the special zinc alloy formulation has been patented and is in use in various GM Overseas plants.

Although special formulations of zinc alloys have been used for temporary dies and for short runs for many years, particularly in aircraft production in the U. S., the GM alloy is said to have extremely long life and outstanding fidelity of reproduction of fine details. In addition, shrinkage is said to be uniform and predictable, thus making it possible to produce dies so close to form as to make little machine work necessary before try-out. As in the case of similar alloys the GM material can be remelted and re-used.

In one trial run, a die for a garnish molding was good for 90,000 pieces and was still usable after that period. A more complicated garnish molding with more detail was still in excellent condition after 12,000 pieces had been produced.

Rubber Use in 1952 Set All-time High

Revision of rubber use statistics for 1952 show that consumption last year of natural and synthetic rubber was at an all-time high of more than 1.26 million long tons. Use last year topped the previous record year, 1950, by more than 2000 tons and was more than 46,000 tons ahead of 1951. Of the total rubber used last year 454,566 long tons were synthetic and the balance of 806,032 long tons consisted of natural rubber.

Cadillac Engineer Wins SAE Henry Ford Award

A project engineer for Cadillac, Bruce M. Edsall, has won the second annual Henry Ford memorial award, established a year ago by the Detroit section of the SAE. He won the certificate and a $200 cash award for preparation of a technical paper entitled "The Idealomatic," a discussion of the ideal automatic transmission. Mr. Edsall is a mechanical engineering graduate of Wayne University and has been employed at Cadillac for 11 years. The annual competition is open to junior SAE members who are under the age of 33 prior to May 31.

Federal-Fawick, Orange Bearing Plan Merger

Directors of Orange Roller Bearing Co., Inc., of Orange, N. J., and Federal-Fawick Corp., Cleveland, have approved initial details for consolidating the two companies. Orange produces needle and roller bearings and steel conveyor belts and Federal-Fawick is a manufacturer of motor trucks, and industrial brakes and clutches. The corporation was formed late last year through consolidation of stock between Federal Motor Truck Co. and Fawick Airflex Co., Inc. When and if the proposed consolidation with Orange is completed, the corporation will consist of five divisions including Fawick Airflex, Fawick Brake, Federal Motor Truck, Orange Roller Bearing, and the Metalsmiths line of conveyors.

Weckler to Retire As Chrysler V-P

Herman L. Weckler has announced his retirement as vice-president and general manager of Chrysler Corp. Mr. Weckler, who at present is on vacation, said he will retire April 30. He will be 65 years old next Aug. 31. He joined Chrysler in 1932 as an assistant to K. T. Keller, vice-president and general manager at that time, and was made first vice-president and general manager of De Soto in 1936. He has held his present position since 1940, serving also as president of Dodge Div. from 1943 to 1946.

AND AVIATION INDUSTRIES

Chrysler Earnings Show Gain in 1952

Although income from sales last year was up only slightly, Chrysler Corp. showed a net profit increase of nearly $8 million over the preceding year. Net earnings in 1952 totaled $78,696,599, representing 3.03 per cent of total sales of more than $2.6 billion. In 1951, the corporation showed a net profit of $71,973,469 on sales of more than $2,546 million. Earnings in 1951 represented 2.83 per cent of sales.

The improved profit showing last year was due primarily to a substantial increase in defense business, plus higher prices authorized for passenger cars. Like other companies in the industry, Chrysler suffered a decline in passenger car and truck production, producing a total of 1,114,228 in 1952 compared with 1,395,833 the previous year.

Chrysler paid more in Federal tax in 1952 than in any other year in history, amounting to $169 million, or more than double the net income. Of the tax total, $31 million is a provision for the excess profit tax. In the previous year, Chrysler paid Federal income taxes totaling $79 million, of which $400,000 was excess profits tax.

Detroit Harvester Buys Pioneer Pump

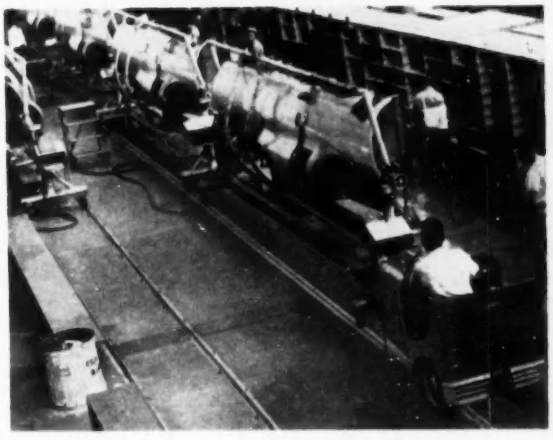
Detroit Harvester Co. has announced the cash purchase of Pioneer Pump & Manufacturing Co. of Detroit which produces coolant and lubrication pumps principally for the machine tool industry. The purchase was made, according to J. Thomas Smith, president of Detroit Harvester, to continue his company's program of expansion and diversification. Detroit Harvester Co. manufactures automotive parts and equipment, farm mowers, and sweepers and has plants in Detroit, Ypsilanti, Toledo, and Zanesville, O.

GMI Plans Expansion

General Motors Institute at Flint, Mich., is expanding with the addition of 83,000 sq ft to the present structure. It will add approximately 40 per cent to classroom, laboratory, and general service areas. As a result of the expansion, enrollment can be increased to 2000 in 1954, making possible graduating classes of approximately 400 by 1956, compared to an average of 293 graduates a year since 1948.

MIDGET LOCO

Using the railroad principle, Lockheed Aircraft Corp. moves its T-33 jet trainer assembly line. A Clark tractor pushes strings of fuselage jigs on wheels in three minutes, formerly a one-hour job for four men.



Chrysler to Expand Canadian Plant

About $17 million will be spent by Chrysler Corp. of Canada, Ltd., on an expansion program at its Windsor, Ont., plant. The two-year program is designed to double passenger car production capacity to approximately 500 cars a day and to add more than a million square feet of floor space, together with additions to the power house and shipping and loading facilities. Chrysler has spent about $12 million on expansions in Canada since 1945.

Automatic Shift for Jaguar

A new automatic transmission, manufactured by the Detroit Gear Div. of Borg-Warner Corp., will be offered as optional equipment on the British Jaguar Mark VII sedan, beginning this spring. The first automatic transmission-equipped Jaguar cars have been received in New York and Los Angeles for introduction to the American market, which currently absorbs more than half of the Jaguar company's production.

The Borg-Warner unit—a three-speed automatic transmission plus torque converter—was developed and built to the specifications of the low-slung British speedster. The device has undergone rigorous tests for two years in the Swiss Alps and elsewhere in Europe and in America.

The Jaguar's new transmission eliminates the clutch pedal. Other features: There is no creep when the car is stationary and in gear. The car can be rocked in snow or mud. Down-hill engine braking is said to be equal to or better than that of second gear in manually operated transmissions.

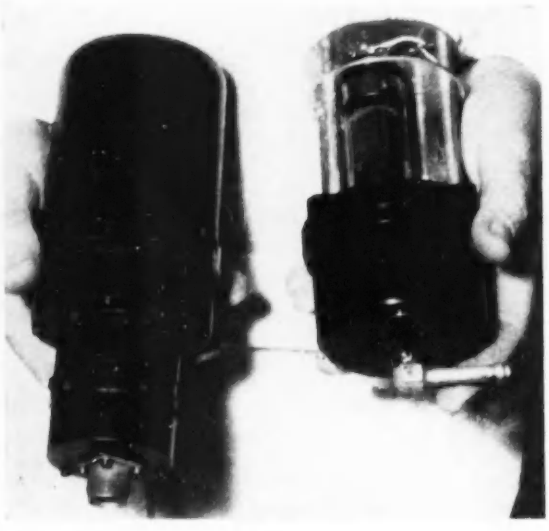
Thompson Plans Expansion

Thompson Products, Inc., is planning to spend $1.25 million to expand its Euclid, O., plant. The enlarged facilities will be used to process a Navy contract for high altitude aircraft accessories. The government will supply about $800,000 worth of testing equipment for the plant.

Bearing Firm May Merge

A plan to merge Jim Brown Stores, Inc., with Bearing Specialists, Inc., has been submitted to stockholders. The merged companies would be known as Bearing Specialists, Inc. Bearing Specialists was formed last May when it acquired all stock of Ohio Ball Bearing, Inc., Indiana Bearings, Inc., Pennsylvania Bearings, Inc., and West Virginia Bearings, Inc. All are now operated as Bearing Specialists Divs.

News of the AUTOMOTIVE



ULTRA-SENSITIVE

Light beams are the only connection between this ultrasensitive governing control and the flight instrument it works from. Ryan Aeronautical Co. developed it to maintain velocity, altitude, etc. within close limits. Two light beams which illuminate the instrument pointer are interrupted alternately as the pointer hunts. A photo cell actuates a relay to control the hunting within narrow limits. Ryan believes uses are almost unlimited, will patent it. Device is shown attached to tachometer, air speed indicator.

Goodyear Subcontracts for Republic

Goodyear Aircraft Corp. announced that a sub-contract has been received from Republic Aviation Corp. for the manufacture of component parts for the sweptwing F-84F Thunderstreak. The firm is in the process of tooling to fabricate the faired-back cockpit canopy and connecting forward turtle deck for the F-84F. The contract will run through 1954.

Crum also revealed that Bandolite, a trademarked lightweight sandwich material produced by Goodyear Aircraft Corp., is now being used in quantity in the construction of the Grumman S2F-1. Bandolite is a lightweight material usually composed of balsa wood or honeycombed plastic enclosed in sheets of aluminum alloy, stainless steel or other metal. The sandwich fabrication is being used as a flooring structure for the S2F-1 and in wing covers, bomb bay and nose wheel doors.

Clevite Corp. Acquires Transitor Products

Clevite Corp. of Cleveland has acquired a majority stock interest in Transitor Products, Inc., of Boston. Brush Electronics Co., a unit of the Clevite group, has been doing development work in the field of transitors for several months and its program will be consolidated with that of the newly acquired company.

MMM Launches Building Program for Research

Purchase of a 125-acre tract for a long-range building program for research purposes has been announced by Minnesota Mining & Manufacturing Co.

The first unit in the multi-million dollar development will be a $3 million laboratory for the company's central research department. Construction of this unit will start in the spring, and is expected to be completed in the fall of 1954.

The two-story structure will be built in the shape of an "E" 375 ft long and will contain approximately 100,000 sq ft of laboratory and office space. It also will house the company's technical library.

Convair Net Rises

Net income of Consolidated Vultee Aircraft Corp. for the year ended Nov. 30, 1952, amounted to over $10.4 million, equal to $4.39 a share on the common stock, compared with $7.75 million, or $3.27 a share for the previous fiscal year.

Sales for last year were nearly $391 million compared with $322 million in 1951. As of Nov. 30, the company's backlog of signed contracts, letters of intent and contracts in negotiation exceeded $1 billion. Present indications are that sales during the 1953 fiscal year should amount to approximately $470 million, the annual report added. Federal taxes last year were $8½ million, compared with $3.8 million the year before.

REGIONAL SALES OF NEW PASSENGER CARS

Zone	Region	December 1952	November 1952	December 1951	Twelve Months 1952	Twelve Months 1951	Per Cent Change: Dec over November	Per Cent Change: Dec over Dec 1951	Per Cent Change: Twelve Months 1952 over 1951
1	New England	20,341	22,128	15,057	238,870	285,555	− 8.08	+35.09	−16.35
2	Middle Atlantic	81,715	71,110	69,050	793,847	967,363	+14.91	+38.38	−17.94
3	South Atlantic	48,298	41,291	39,107	491,282	601,045	+16.97	+23.50	−18.26
4	East North Central	102,674	90,413	71,050	1,060,581	1,291,496	+13.56	+44.51	−17.88
5	East South Central	18,942	18,763	16,867	195,897	240,562	+ 0.95	+12.30	−18.67
6	West North Central	33,878	32,557	32,622	402,934	525,624	+ 4.06	+ 3.85	−23.34
7	West South Central	33,367	33,151	31,458	377,208	454,793	+ 0.65	+ 6.07	−17.06
8	Mountain	13,400	12,929	11,415	143,182	172,543	+ 3.64	+17.39	−17.02
9	Pacific	47,291	37,914	33,458	454,593	521,920	+24.73	+41.34	−12.90
	Total—United States	399,906	360,256	310,084	4,158,394	5,060,903	+11.01	+28.97	−17.83

States comprising the various regions are:—Zone 1; Conn., Me., Mass., N. H., R. I., Vt.—Zone 2; N. J., N. Y., Pa.—Zone 3; Del., D. of C., Fla., Ga., Md., N. C., S. C., Va., W. Va.—Zone 4; Ill., Ind., Mich., Ohio, Wis.—Zone 5; Ala., Ky., Miss., Tenn.—Zone 6; Iowa, Kan., Minn., Mo., N. D., S. D.—Zone 7; Ark., La., Okla., Tex.—Zone 8; Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo.—Zone 9; Cal., Ore., Wash.

AND AVIATION INDUSTRIES

GM Builds Aluminum Foundry in Arkansas

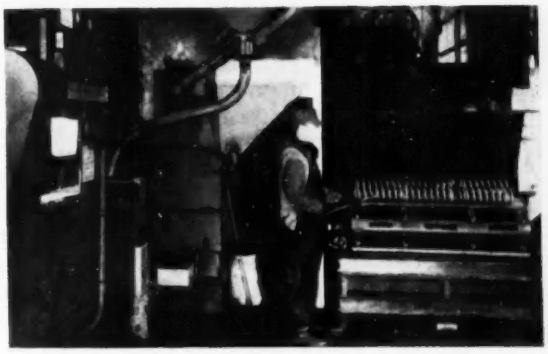
General Motors Corp. has announced the start of construction of a new modern aluminum foundry at Jones Mill, Ark., for its Fabricast Div. Scheduled for completion by August of this year, the new plant will total approximately 100,000 sq ft. It will supplement the division's Bedford, Ind., operation in producing permanent mold aluminum castings, many of them intricate types used in torque converters. Part of the plant's production will be used for defense purposes.

U. S. Rubber Plans New Research Lab.

United States Rubber Co. is planning to create a new research center at Emerson, N. J., for basic research in the fields of rubber, chemicals, synthetics, textiles, and plastics. It has signed a conditional purchase contract for about 80 acres of land with the proviso that the borough of Emerson re-zone the property which now is in a residential section. The new facility is designed to supplement but not supplant the company's existing research laboratories at Passaic, N. J.

BOUNCE-BUILDING

Unloading end of draw furnace and loading end of shot peening machine, processes in manufacture of automobile coil springs, are shown at Burton Auto Spring Corp. plant.



New Tank Retriever

Production of a new tank recovery vehicle is planned for the Chrysler Detroit Tank Plant as soon as engineering work has been completed.

A spokesman said the Chrysler Detroit Tank Plant has successfully put into effect the stretch-out program that it was given in early December last year by the Ordnance Corps. It was disclosed that more than 27,000 tanks had been built or modified by Chrysler during World War II and the present emergency.

Chrysler Breaks Ground For New Tank Facility

Ground was broken this month for construction of a $3.1 million government-owned plant which the Army previously announced would be built and operated by Chrysler Corp. for modification and final processing of military tanks for Army Ordnance.

The new plant, which has been designated by Chrysler as the Corporation's Delaware Tank Depot, will be located on an 87-acre site directly adjoining the manufacturing operations of the Chrysler Delaware Tank Plant, Newark, and will function as an integral part of that facility.

It has been revealed that in the near future the present plant will begin production of the Army's first production type heavy tank, the T-43. This new Chrysler-built heavy tank, mounting a 120-mm gun, has been called the U. S. counterpart of Russia's Joseph Stalin III, of 57-tons.

In a previous announcement revealing plans for the new addition for which ground was broken today, the Army stated that it would be used to "incorporate new engineering developments which may be applicable to tanks that have already been built."

It is anticipated that the new plant, measuring 400 x 380 ft, will be in operation late this year.

1952 NEW PASSENGER CAR REGISTRATIONS*

Arranged by Makes in Descending Order According to the 1952 Twelve Months' Totals

MAKE	December 1952	November 1952	December 1951	TWELVE MONTHS Units 1952	Units 1951	Per Cent of Total 1952	Per Cent of Total 1951
Chevrolet	78,084	81,667	65,621	852,542	1,067,042	20.49	21.09
Ford	80,172	73,948	55,888	732,481	862,309	17.61	17.04
Plymouth	52,064	24,202	26,040	433,134	542,649	10.42	10.72
Buick	23,991	29,099	25,136	310,808	392,285	7.47	7.75
Pontiac	22,769	23,786	23,347	266,351	337,821	6.41	6.68
Dodge	23,529	19,471	17,103	246,464	298,603	5.93	5.90
Oldsmobile	17,255	20,420	17,187	218,189	273,472	5.25	5.40
Mercury	22,573	18,247	15,491	185,883	233,339	4.47	4.61
Studebaker	15,803	12,722	12,511	157,902	205,514	3.80	4.06
Nash	12,801	11,522	8,956	142,520	140,035	3.43	2.77
Chrysler	11,366	8,404	8,142	113,392	149,435	2.73	2.95
De Soto	10,151	6,906	7,906	91,677	112,643	2.20	2.23
Cadillac	4,777	7,661	6,551	87,806	97,093	2.11	1.92
Hudson	5,683	4,845	5,559	78,509	96,847	1.89	1.91
Packard	6,149	3,796	4,622	66,346	66,999	1.60	1.32
Kaiser	3,506	3,654	2,796	41,022	52,286	.99	1.03
Willys	3,858	3,417	1,238	41,016	26,049	.99	.51
Lincoln	2,890	2,210	1,418	29,110	25,816	.70	.51
Henry J	1,792	1,891	2,494	28,718	51,372	.69	1.02
MG (British)	573	493		7,449		.18	
Austin (British)	322	280	353	4,804	3,800	.12	.08
Hillman (British)	377	371		4,782		.11	
Ford (British)	352	316	267	3,854	3,508	.09	.07
Jaguar (British)	386	319		3,349		.08	
Crosley	34	47	248	2,679	5,304	.06	.10
All State	90	111		1,566		.04	
Misc. Domestic	40	18	185	982	3,162	.02	.06
Misc. Foreign	519	433	1,025	5,061	13,520	.12	.27
Total—All Makes	399,906	360,256	310,064	4,158,394	5,060,903	100.00	100.00

* Based on data from R. L. Polk & Co.

News *of the* Industry

Clark Had Record Sales; Announces Price Cuts

Clark Equipment Co. announced that 1952 set new company highs in both sales and earnings.

Preliminary figures indicate that total sales for 1952 were $132 million and that earnings, after taxes, will be in excess of $5.5 million. This represents a gain over 1951 of approximately $2 million in sales and approximately $225,000 in earnings.

Price reductions on five of its electric battery-powered fork-lift trucks, ranging from $37 to $299, to be effective immediately, were announced.

Dualoc in Production

Dualoc Drive, Inc., of Rockford, Ill., has completed tooling and started production on their new nonequalizing differentials. The greater part of their present production is going into the funeral industry but as numerous other tests, now being conducted are completed, plans are underway to expand production to encompass several other adaptations in other fields.

The nonequalizing feature of the Dualoc differential automatically shifts the greater power to the wheel with the best traction.

GATX Shows Plastics

Striking evidence of the growing industrial applications of reinforced plastics was to be found at a recent exhibit of plastic products by the Plastics Div. of General American Transportation Co. in New York. Prominent among the products on display were battery cases for jet aircraft and automobiles.

Safety Study by Cornell Aerolab

The Industrial Div. of the Cornell Aeronautical Laboratory has begun a commercially sponsored research program directed toward better protection for auto passengers in case of accident. The division also is developing a cylindrical ice cleat for auto tires to reduce skidding and to improve traction in winter driving.

On the basis of work done by its flight research department in aircraft stability, the laboratory has obtained a contract to investigate the handling characteristics of automobiles. The laboratory will take into consideration suspension, steering, tires, shock absorption, force of the air, inertia and other factors that contribute to the driver's ability to control.

Witbeck to Produce Trainer Components

Witbeck Aircraft Corp. has been awarded a major subcontract by Temco Aircraft Corp. for fabrication of major components for the latter's T-35 Buckaroo military trainer and light armed aircraft. Included are complete empennages, outer wings, seats, and quadrants.

(*Turn to page 59, please*)

1952 NEW TRUCK REGISTRATIONS*

Arranged by Makes in Descending Order According to the 1952 Twelve Months' Totals

MAKE	December 1952	November 1952	December 1951	TWELVE MONTHS Units 1952	Units 1951	Per Cent of Total 1952	Per Cent of Total 1951
Chevrolet	25,675	25,610	20,806	272,249	350,344	33.49	34.90
Ford	16,990	16,008	16,138	179,523	250,802	22.11	24.98
Dodge	7,684	7,972	7,497	102,129	106,600	12.58	10.62
International	6,295	7,067	5,588	92,788	95,184	11.43	9.48
G. M. C.	6,514	6,809	6,061	79,612	100,285	9.80	9.99
Studebaker	2,194	2,295	2,180	28,985	32,675	3.57	3.25
Willys Truck	1,110	1,090	949	11,762	15,290	1.45	1.52
White	626	906	720	10,853	12,260	1.34	1.22
Willys Jeep	967	744	828	8,594	9,002	1.06	.90
Mack	517	493	538	7,138	9,794	.88	.98
Diamond T	227	256	249	3,423	4,508	.42	.45
Reo	253	330	196	3,393	3,427	.42	.34
Divco	166	170	165	2,752	3,752	.34	.37
Brockway	177	185	103	1,752	2,182	.22	.22
Autocar	140	147	133	1,595	2,112	.20	.21
Federal	81	50	61	841	1,008	.10	.10
Kenworth	40	56	25	705	668	.09	.07
F. W. D.	38	62	38	543	501	.07	.05
Pontiac	41	75	72	541	908	.07	.09
Sterling	28	19	23	250	334	.03	.03
Peterbilt	10	18	11	236	301	.03	.03
Misc. Domestic	154	97	201	2,141	1,662	.26	.17
Misc. Foreign	24	18	14	292	251	.04	.03
Total All Makes	69,949	70,477	62,596	812,099	1,003,850	100.00	100.00

* Based on data from R. L. Polk & Co.

Stewart - Warner Corp.—Jack O. Coffey was recently promoted to aircraft sales manager.

GMC Truck & Coach Div.—Thomas E. Wilson has been appointed general manufacturing manager.

Purolator Products, Inc.—Donald C. Huber is now sales promotion manager.

BullDog Electric Products Co.—Kent P. Stiner has joined the firm as product engineering coordinator.

Clark & Bobertz, Inc. — G. H. Bobertz, Jr., has given his name to the former Clark & Richerd, Inc., agency. Personnel remain unchanged.

Henry Disston & Sons, Inc.—P. C. Biemuller was named supervisor of the sales staff, succeeding Ellwood J. Gebhart, who was appointed manager of the marketing division.

Men in the News

Current Personnel Appointments and Changes at Plants of Automotive Manufacturers and Their Suppliers

Clearing Machine Corp. — A. L. West was elected treasurer recently.

Tinnerman Products, Inc. — Lawrence H. Flora was named director of engineering.

Eaton Mfg. Co. — W. A. Mattie has been appointed assistant general manager of the heater division.

Kysor Heater Co.— Raymond A. Weigel was elevated to the presidency by the board, succeeding W. A. Kysor, who will be chairman.

Hupp Corp.—**Paul B. Best, Jr.,** has joined the firm as general manager to direct automotive sales.

Ford Motor Co. — Appointment of **Robert S. McNamara,** controller, as a member of the administrative committee has been announced.

Oldsmobile Div. of General Motors Corp. — **Donald C. Burnham** was named assistant chief engineer in charge of body, sheet metal and chassis design. **Lowell A. Kintigh** is now assistant chief engineer in charge of engine, transmission, experimental test and development. **Robert T. Rollis** succeeds Burnham as manufacturing manager. **Robert J. Cook** has been promoted to chief inspector succeeding Rollis, **Russell E. Hansen** is now in charge of all production engineering, and **Frank W. Haeger** is general supervisor of production engineering on the jet engine program.

Nash-Kelvinator Corp. — **George Romney,** corporation executive vice-president, and **George G. Brown,** dean of engineering at the Univ. of Michigan, were elected to the board recently. **A. D. Gage** has been promoted to assistant advertising manager of Nash Motors. At Nash Motors of Canada, Ltd., **R. A. Gibson** was appointed general sales manager and **Don F. Yonson** succeeds him as purchasing agent.

Timken-Detroit Axle Co.—**Col. William F. Rockwell,** board chairman, has been named director of productivity for the Mutual Security Administration.

Seiberling Rubber Co.—**Walter T. Johnson** is now general sales manager, succeeding **C. A. Reed,** who is now assistant to the president.

Willys-Overland Motors, Inc.—**Richard E. Reiter** has joined Willys as superintendent of the landing gear division.

Goodyear Aircraft Corp. — **J. L. Gimbel** is manager of a new finance division. **W. A. Lloyd** becomes manager of the master planning department, **E. A. Brittenham** is assistant chief engineer, and **J. Penning** is manager of a new piloted aircraft engineering division. **R. M. Hudak** has been named manager of the Litchfield Park, Ariz., plant.

Link Aviation, Inc.—**E. Allen Williford** has been advanced to president, succeeding **E. A. Link,** who continues as board chairman and director of research.

Eclipse-Pioneer Div. of Bendix Aviation Corp.—**Milo F. McCammon** has been appointed director of manufacturing.

F. L. Jacobs Co.—**Thomas J. Riggs, Jr.,** is now general sales manager.

Burton Auto Springs Corp.—**Tore Franzen,** formerly with Chrysler Corp. Engineering Div., has joined the firm as Midwest area engineering representative.

Consolidated Engineering Corp. — Promotion of **Hugh F. Colvin** to vice-president and treasurer has been announced.

Air Associates, Inc. — Election of **J. E. Ashman** as president and a director has been revealed. He joined the firm recently from Rockwell Mfg. Co.

Champion Spark Plug Co. of Canada, Ltd.—**Charles A. Speers** has been elected managing director.

Necrology

Melvin H. Kuhl, 52, assistant general manager of the Industrial Div. of Timken Roller Bearing Co., died at Canton, O., on Feb. 11.

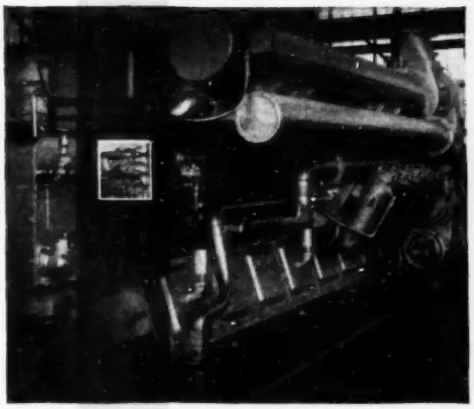
Raymond H. Rauen, 52, vice-president of U. S. Spring & Bumper Co., died recently at Los Angeles, Calif.

Gustavus A. Axelson, 82, head of Axelson Mfg. Co. until his retirement in 1946, died at his home in Los Angeles, Calif.

William C. Mack, 94, one of three brothers who designed the first Mack truck, died at his home on Staten Island, N. Y., on Feb. 13.

Daniel Gurney, 52, vice-president and director of engineering at Marlin-Rockwell Corp., died at Jamestown, N. Y., on Feb. 3.

ON DIESEL ENGINES



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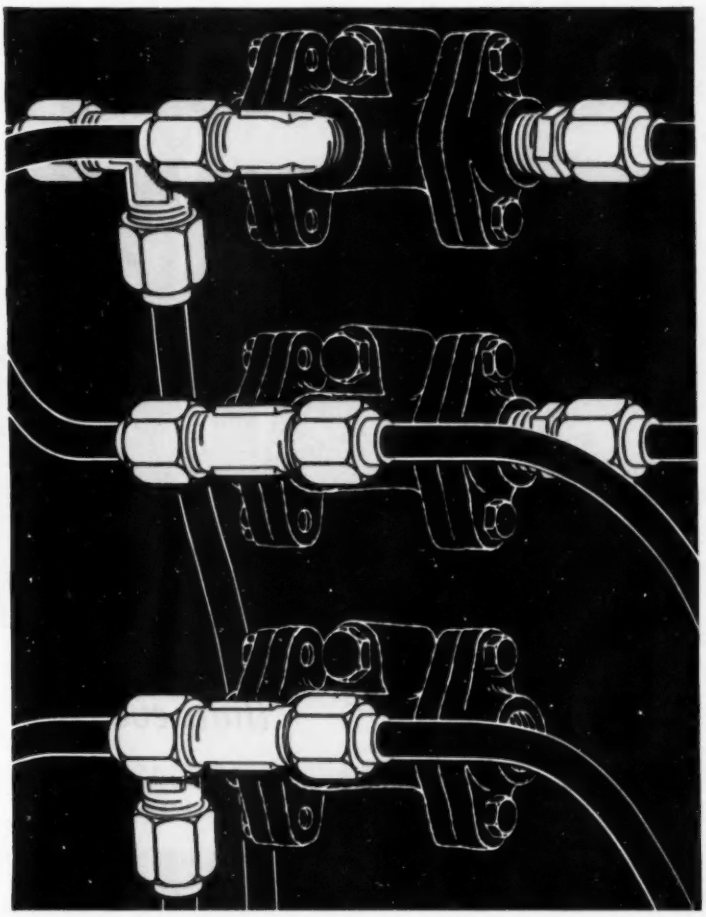

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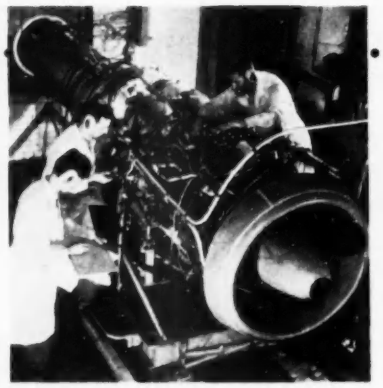

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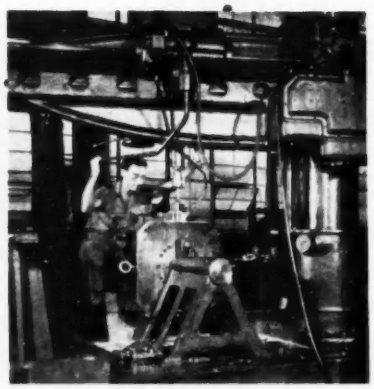

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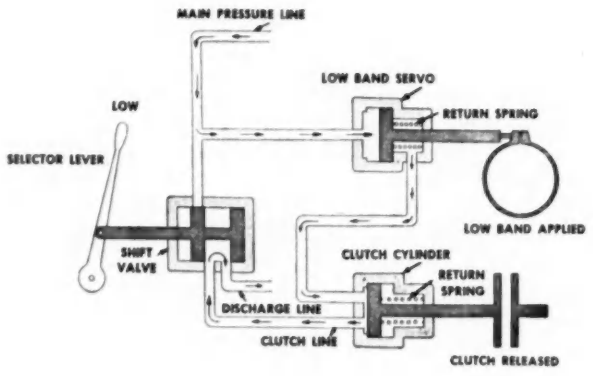
Fig. 1



Low range selection.

New Valve Mechanism of the 1953

THE 1953 Chevrolet Powerglide automatic transmission incorporates a new automatic shift mechanism which provides Drive with a low and cruising range. The flexibility of operation in Drive is extended to supply faster, more positive pick-up from starts, higher acceleration at traffic speeds, and increased power for hill climbing or heavy going in mud, sand, or snow. Car speed and load requirements control the operation of the automatic shift which contributes to high fuel economy by minimizing the possibility of engine racing or overloading.

In operation, the car, moving forward in Drive from a standstill, is always in low range and upshifts to the cruising range as speed is attained. Because the automatic shift mechanism is linked to the throttle, the point at which the upshift occurs varies with the pressure on the accelerator pedal. Thus, with the accelerator held at the floor, acceleration in low range will continue up to about 40 mph. The more powerful engine provides an adequate reserve of power at cruising speeds, so an upshift occurs at this point, before engine speed becomes excessive.

Downshifts from cruising range are instantly available when fast acceleration or extra power are needed at traffic speeds. Below approximately 40 mph, the transmission will shift from cruising range to low range if the accelerator is fully depressed. At lower speeds, the downshift will occur at less than full throttle, and with the throttle closed, as when slowing to a stop, the downshift takes places at about 10 mph.

Manual Low is retained to provide extra braking against engine compression when required to prevent upshifting during slow or slippery driving conditions, and to permit rocking the vehicle out of ruts by shifting betweel Low and Reverse.

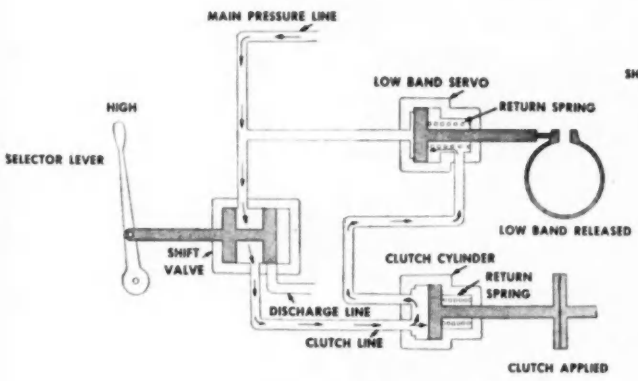
A larger, more efficient three element torque converter is used and the overrun coupling is eliminated. The new converter provides improved cruising economy and retains the braking and low-speed, push-starting characteristics of the previous five element design.

The new Powerglide transmission uses the same basic components as the previous design and has the same manual selector positions. The low range in Drive has the same ratio as the manual Low, and the cruising range is the same as the previous Drive. The low band is used more frequently in the automatic shift Powerglide and is redesigned for increased durability and better drum contact. Its friction surface is wider and the metal band is made of steel instead of malleable cast iron.

The automatic shift feature is provided by incorporating an automatic shift valve in the hydraulic circuit used in Drive. Vehicle speed and engine loading control the operation of this valve for selecting the appropriate range. Actuation of the low and cruising range in Drive is the same as that caused by the manual selection of Low or Drive in the previous Powerglide. The control of oil pressure to the high clutch applies or releases the clutch and low band so that the planetary gears are either used or by-passed when the vehicle is in forward motion.

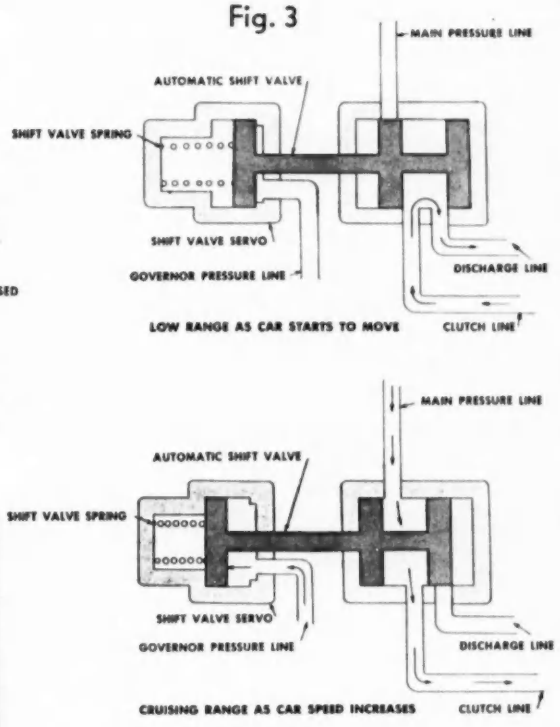
Coming to the hydraulic circuits and mechanical motion resulting from movement of the shift valve,

Fig. 2



High range selection.

Fig. 3



Shift valve operation.

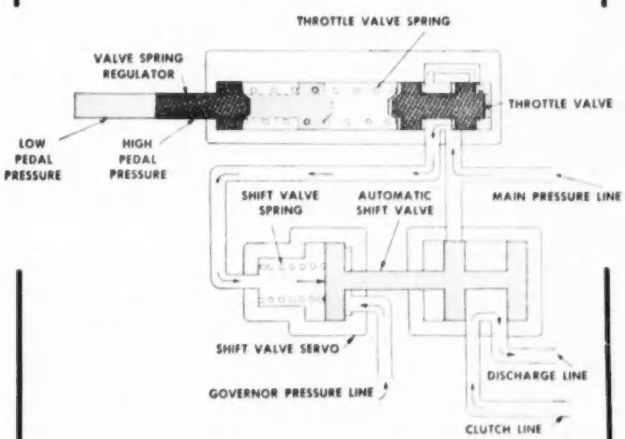
Powerglide Transmission

Fig. 1 shows the arrangements of units when the selector lever is in Low. Oil pressure enters the low band servo, compressing the return spring as the piston moves to apply the low band. The groove in the shift valve spool connects the clutch cylinder with a discharge opening to the sump. Any fluid in the return spring chamber of the low servo moves through the clutch cylinder and out this discharge port. The low band is now applied and the return spring in the clutch cylinder holds the clutch plates separated.

When the shift valve is moved to the high range as shown in Fig. 2, the groove in the shift valve opens the clutch line to oil pressure and the discharge port is closed. Oil pressure now compresses the return spring in the clutch cylinder and brings the clutch plates into contact. This same oil pressure also enters the return spring side of the low servo, here it balances the oil pressure compressing the spring, and the forces of the spring moves the piston and releases the low band.

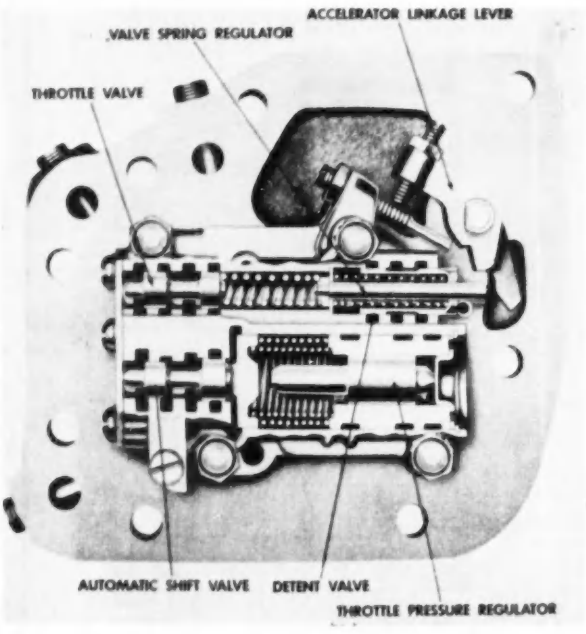
In the previous Powerglide, the valve controlling the flow of oil pressure was operated by moving the selector lever to Low or Drive. In the new Powerglide for 1953, the selection of Drive directs oil pressure to an automatic shift valve, the relative position of which is controlled by

Fig. 4



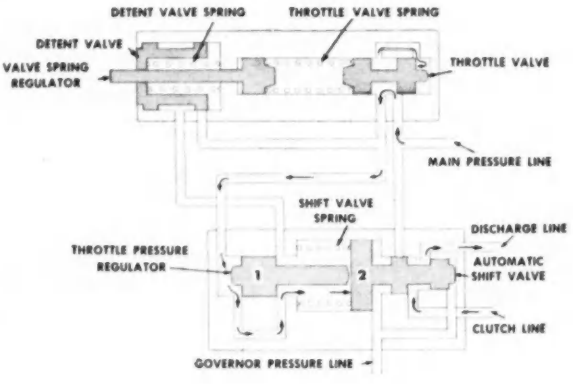
Throttle valve operation.

Fig. 5



Part-cutaway view of valves and valve bodies in 1953 transmission.

Fig. 6



Low range as car starts to move.

opposing hydraulic pressures. This is accomplished by providing the new shift valve with a piston operating in a cylinder, and applying speed sensitive pressure at one end, and load sensitive pressure at other. (Fig. 3.)

The speed sensitive hydraulic pressure is produced by the rear pump in the transmission and is regulated by a governor controlled valve. As the vehicle begins to move, oil pressure is developed by the rear pump and the pressure it passes to the shift valve piston is controlled by a governor driven by the transmission mainshaft.

A spring presses against the piston head, holding the automatic shift valve in the low ranges as the vehicle begins to move. As the vehicle speed increases, the pressure passed by the governor becomes greater and opposes the force of this spring. When the hydraulic pressure through the governor valve is high enough, the piston spring is compressed and the shift valve moves to the high or cruising range.

However, extra power is sometimes required after the vehicle begins to move. Rapid pick-up after a start, sudden acceleration for passing in traffic, or travelling up a hill, requires high power at speeds where pressure is passed by the governor to the shift valve piston.

A load sensitive hydraulic pressure is added to the force of the shift valve piston spring so that low range can be used to obtain the transmission gear multiplication for these power demands. Pressure from the main hydraulic line in the transmission is regulated by the accelerator pedal to supply an additional force opposing the governor pressure. A throttle valve, controlled by linkage to the carburetor, passes increasing main line pressure to the shift valve piston as the accelerator pedal is depressed.

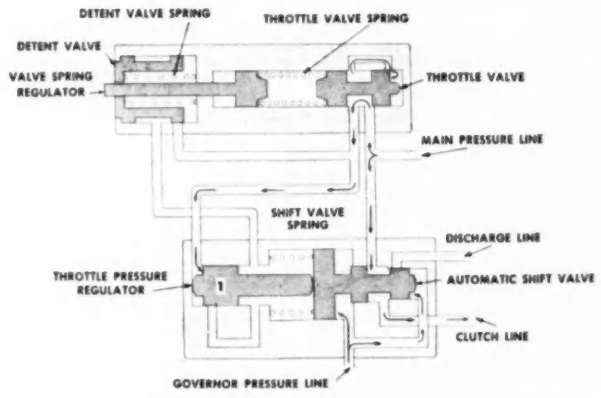
The throttle valve as illustrated in Fig. 4, consists of a spool having two lands separated by a groove. This spool operates in a body having ports which open to the main line and to the shift valve piston.

A spring holds the throttle valve spool in a position where its groove connects the main line to the shift valve piston line. Main line oil pressure also is channeled into a cavity behind the valve, increasing the area on which it acts. As a result, the entrance of main line pressure tends to move the throttle valve against its spring, restricting the pressure passed to the shift valve piston. A plunger, linked to the carburetor throttle plate, regulates the spring force that opposes the main line pressure from moving the valve spool. Consequently, as the accelerator pedal is depressed, increasing main line pressure, is passed by the throttle valve to oppose the governor pressure on the shift valve piston. Therefore, a higher vehicle speed is required before pressure from the rear pump can effect an upshift.

The preceding diagrams illustrate the basic principles incorporated in the automatic shift Powerglide. However, smoothness of operation, simplicity of manufacture, and the provision of a forced downshift modify the construction of the valves and valve bodies in the actual transmission.

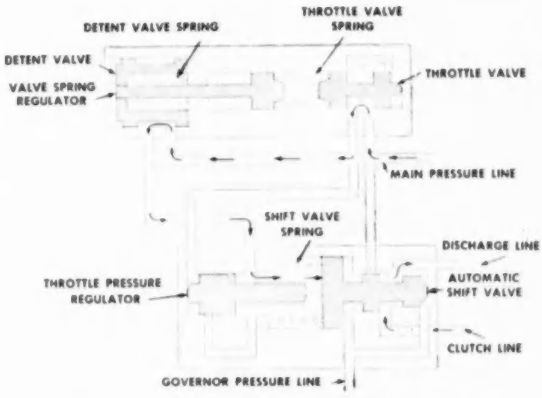
The main line pressure passed by the throttle valve to the shift valve piston is regulated by a plunger in the shift valve body. Instead of using a piston operating in a separate cylinder for controlling the shift valve position, the piston is machined on the end of the valve spool. Governor pressure is channeled to the end of the shift valve spool to increase the valve area against which it acts. In addition, the throttle valve spring regulator slides in a spring loaded detent valve.

Fig. 7



Cruising range as car speed increases.

Fig. 8



Low range with detent valve depressed.

Fig. 5, at the far left, illustrates these modifications.

As the vehicle starts to move, main line pressure passed by the throttle valve moves regulator, shown at (1) in Fig. 6, towards the shift valve (2) and uncovers a channel admitting the pressure from the throttle valve to the shift valve piston. This pressure added to the spring force againsts the piston head holds the shift valve in the low range.

As the vehicle speed increases, higher pressure is passed by the governor, and when it becomes great enough to counterbalance the forces on the piston head, the shift valve moves to the cruising range. The piston head then butts against the regulator (1) in Fig. 7 and closes off the channel bringing pressure from the throttle valve to the piston head. This reduces the area against which the pressure from the throttle valve acts. Consequently, there is a large reduction in the forces opposing the pressure through the governor. Only a large reduction in governor pressure, or a large increase in pressure from the main line will return the shift valve to the low range.

If the vehicle speed is reduced appreciably lower than where the upshift occurred, the decreased pressure from the governor will be counterbalanced by the pressure through the throttle valve imposed on the end of the regulator. The regulator pressing on the piston head moves the shift valve, opening the channel to the piston head and admitting the throttle valve pressure to oppose the pressure from the governor across the whole head of the piston. The shift valve is now held in the low range.

Even if the vehicle speed is not reduced, a forced downshift can be made at speeds up to approximately 40 mph. This is accomplished by depressing the accelerator pedal all the way. As the accelerator pedal approaches the end of its travel, the shaft of the spring regulator for the throttle valve is flush with the detent valve in which it slides. Further pressure compresses the detent valve spring, and a groove in the valve opens the main line pressure directly to the shift valve piston head as shown in Fig. 8. The larger area against which the main line pressure now acts increases the forces opposing the governor pressure and moves the shift valve to the low range.

The movement of the shift valve to the cruising or the low position is rapid,and it is firmly held in either of these locations. This feature prevents slipping of the clutch plates or dragging of the low band and provides better durability to their facings.

The shift valve begins to move as soon as there is a slight advantage in one of the opposing forces controlling its position. If the transmission has been operating in the low range, the shift valve groove admits pressure from the main line to the clutch cylinder as soon as the valve spool begins to move. This main line pressure also presses against the walls at each end of the shift valve groove, and since the area nearest the piston end of the valve is the larger, the force against it is greater. The valve movement is accelerated by this additional force. If the valve begins to move from the cruising to the low range, the pressure in the groove is discharged to the sump and this sudden release of holding force accelerates the valve movement to the low range.

Since the area against which the pressure from the throttle valve acts increases or decreases depending upon the shift valve position, the movement of the shift valve causes a large difference in the magnitudes of the opposing forces controlling its position. Consequently, the shift valve does not move back and forth, or "hunt," at speeds slightly above or below the point where a shift occurs.

Softer shifting at high speeds is provided by making the main line oil pressure sensitive to vehicle speed. Governor pressure is applied to the pressure regulator valve in Drive for this purpose. The vacuum modulator is retained from the previous Powerglide

(*Turn to page* 84, *please*)

Effects of Piston Pin Offset

A Discussion of Factors Tending to Cause Piston Slap and Description of an Experimental Setup for Determining Action of Piston in Cylinder While in Operation.

ONE method of preventing—or alleviating trouble from—piston slap in engines with light-alloy pistons consists in slightly offsetting the piston-pin axis from the piston axis. This feature of engine design is said to have been known for about twenty years, but it was prominently brought to the attention of the engineering world a little more than three years ago, when it was incorporated by Cadillac in its 331 cu in. V-eight engine.

In an engine of the type in which the piston-pin axis intersects the piston axis and the latter the crankshaft axis, the piston remains in contact with the "off" side of the cylinder wall until the end of the compression stroke. Then, upon reversal of the angularity of the connecting rod, it "flops" over to the principal-thrust side (which we will call the "pressure" side for short), taking up the clearance between piston and cylinder. During this transverse motion the piston apparently remains substantially parallel to the cylinder, and therefore comes in contact with the pressure side over its whole length (or the whole length of its skirt) at the same time. The cause of the transverse motion is the horizontal or transverse component of the connecting-rod reaction, which changes its direction as the crank passes through top center.

If the piston pin is offset from the axis of the piston, the piston is subjected to a moment tending to turn it around the piston pin, in addition to the transverse force due to the angularity of the connecting rod. This results in a rocking or cocking motion of the piston within the cylinder. The rocking motion, however, does not take place around the piston-pin axis as a fixed center, because, owing to the clearance of the piston in the cylinder, the piston pin has a certain freedom in the transverse direction. It takes place around either the upper or the lower end of the skirt, provided, of course, the ring belt is of smaller diameter than the skirt. When thus arranged, therefore, one end of the piston moves over from the "off" to the "pressure" side of the cylinder before the other end moves over, from which alone a reduction in the force of impact and in any resulting noise might be expected.

Aside from a brief reference to the subject in an S.A.E. paper by H. F. Barr and E. N. Cole, dealing with the application of the principle in the Cadillac engine, little has been published on it. The piston pin evidently can be offset either to the "pressure" side or the "off" side of the piston, and the type of rocking motion referred to in the foregoing will result in either case, but it is reasonable to assume that the effect with respect to slap-suppression will not be the same. Then there is the question of the optimum magnitude of the offset with relation to the piston diameter, as well as that of the exact relation between the offset and the intensity of the piston impact or slap. A research program intended to throw light on these questions was undertaken by the Research Department of the Mahle Co. of Stuttgart, Germany, and was reported on in a paper read before the Automobile-Engineering Section of the German Society of Engineers by Dipl.-Ing. A. Meyer. The paper was printed in *Automobiltechnische Zeitschrift* for June last.

Various means for arriving at a clear understanding of the phenomenon of piston slap were considered, including measurement or recording of the vibration caused by it, or of the intensity of the noise produced, by means of microphones. It appeared, however, that vibration and noise caused by other disturbances due to engine operation would vitiate the results. It was therefore decided to make use of a method permitting of actually recording the transverse motions of both ends of the piston skirt, a method which had been applied previously to determining the clearance in injection pumps. By this method parts of the cylinder and piston are made to act as an electric condenser, and any variation in the distance between them (the clearance) results in a change in the capacity of the condenser, which can be measured accurately by electrical methods and recorded by means of an oscillograph.

Experiments were carried out on a single-cylinder

By P. M. Heldt

test engine of 4.2 in. bore and 4.6 in. stroke.* This engine lent itself well to the purpose, because it had a built-up crankshaft and a connecting rod with undivided big end, to which the slip rings necessary for the electrical connections could be readily applied. Figure 1 is a side view of the piston, with one-half shown in section. It will be seen that arc-shaped inner condenser plates of trapezoidal or dovetail cross section are mounted on the piston at both ends of the skirt, on both the "pressure" and the "off" side. These plates are insulated from the piston by strips of plastic material shown in black, and are held rigidly in position by ring nuts screwed over the piston from both ends. Electrical connection has to be made from each of the four condenser plates on the piston. This is accomplished by providing slip rings on the upper and lower bearing bosses of the connecting rod, additional slip rings on the crankshaft, and brushes bearing on these rings. Slip rings at opposite ends of the connecting rod are connected by wires or cables extending along the shank, and are held in place against inertia forces by sheet-metal guards. Locations of the slip rings are clearly shown in Fig. 2.

As shown in Fig. 3, the electrical equipment needed to record the transverse movements of the piston includes a source of alternating current (u) of eight volts and a frequency of 20,000 cycles per second, a condenser C_2 of known capacity, an oscillograph V of the cathode-ray type, and a commutator or switch permitting of connecting any of the four condensers C_1 formed by the cylinder wall and the piston plates in series with condenser C_2 across the source of current. The oscillograph is connected across the condenser of unknown capacity formed by the cylinder and one of the piston plates, and measures or records the voltage drop u_1 across this condenser, which is equal to the difference between the voltage u of the source and the voltage drop u_2 across condenser C_2 of known capacity. The following relation then holds:

$$\frac{u_1}{u} = \frac{C_2}{C_1 + C_2}.$$

The value of the ratio u_1/u can be determined by means of the oscillograph, and since C_2 is known, C_1 can be calculated by means of the above equation. As the condenser in the cylinder is of the plate type, its capacity is given by the equation

$$C_1 = \frac{\epsilon\, \epsilon_0\, F}{s},$$

where F is the effective area of the condenser plates; s, the distance between plates (piston clearance at the

* In converting the metric to English measures the inch was assumed to be equal to 25 mm instead of 25.4, to avoid the use of long fractions.

Fig. 1

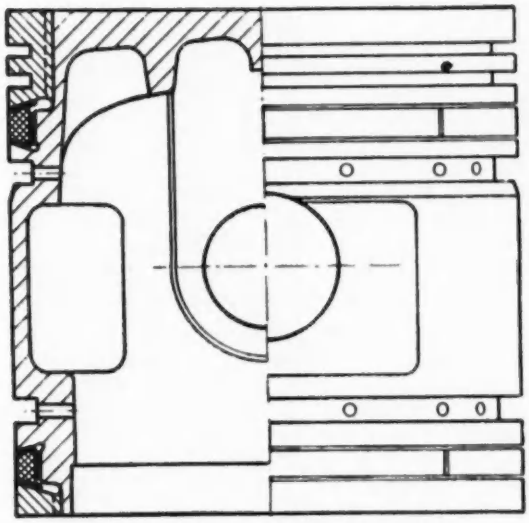


Fig. 1—Side view of piston used in the tests, with one-half shown in section.

Fig. 2

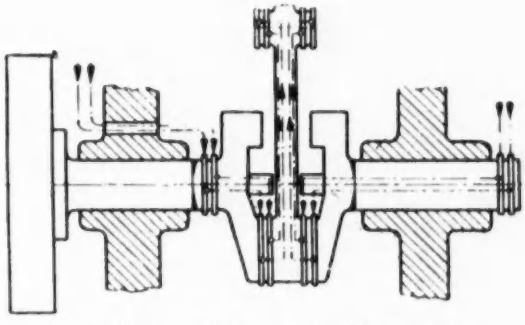


Fig. 2—Arrangement of electric circuits on crank train.

Fig. 3

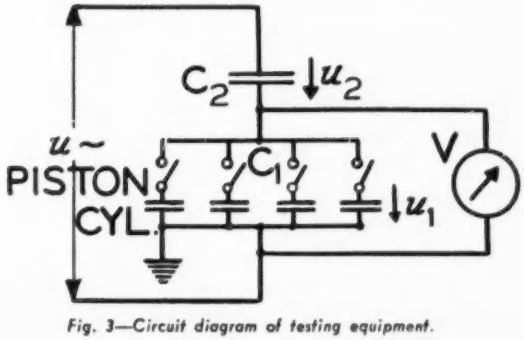


Fig. 3—Circuit diagram of testing equipment.

Fig. 4

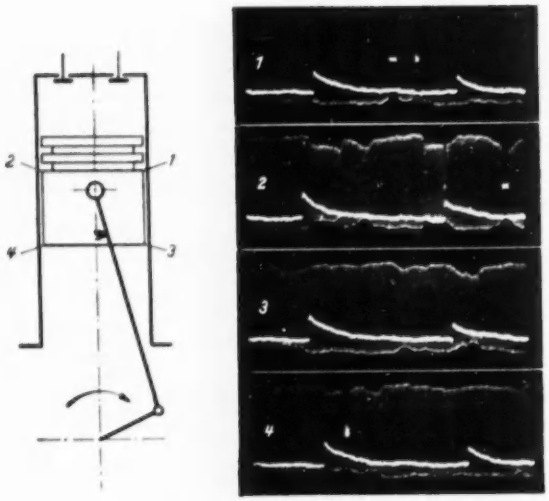


Fig. 4—Oscillograms of piston transverse motion for definite engine operating conditions.

Fig. 5

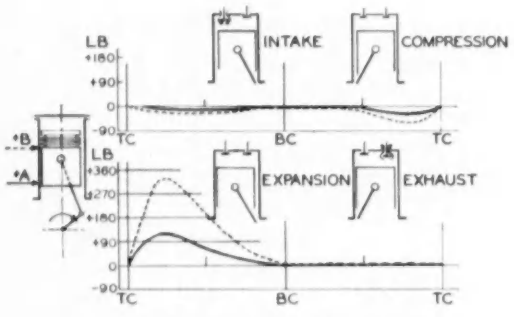


Fig. 5—Reaction of the cylinder wall on the piston plotted against crank angles.

Fig. 6

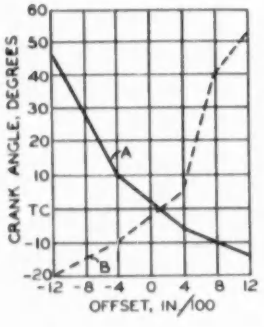


Fig. 6 — Beginning of pivotal motion of piston around the lower edge (A) and the upper edge (B) of the piston skirt.

Fig. 7

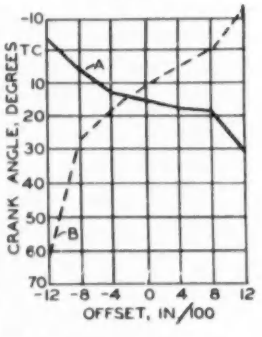


Fig. 7—End of pivotal motion of piston around the lower edge (A) and the upper edge (B) of the piston skirt.

point where the piston plate is located); e_o, a constant representing the effect of the shifting motion between the two plates, and e, the specific inductive capacity of the medium separating the plates (oil or an oil-gas mixture). By combining the two foregoing equations we get the following expression for the clearance between piston and cylinder wall at the point of measurement:

$$s = \frac{e\, e_o\, F}{C_2 \left(\frac{u}{u_1} - 1 \right)}$$

Figure 4 shows oscillograms of transverse piston movement obtained with this equipment under definite engine operating conditions, and the drawing on the left indicates the positions on the piston skirt to which the four oscillograms apply. Each oscillogram shows —by the width of the "band" under the curve—how the distance between the particular point on the piston and the cylinder wall varies throughout a complete engine cycle. The greater the width of the "band" below the curve, the greater the clearance between piston and cylinder wall at the particular point. The dead center position is separately marked in on each oscillogram. The highest peak of the curve marks the beginning of the power stroke, the somewhat lower peak the beginning of the suction stroke. By synchronizing the cross sweep of the cathode ray with the engine cycle, a stationary diagram is obtained on the screen of the cathode-ray tube, and this can be photographed.

From the equation for the piston clearance s it can be seen that this factor is smaller the smaller the u_1, which is the entity measured or recorded by the oscillograph. Thus, where the width of the "band" under the curve in the oscillograms drops to zero, the clearance is zero.

In Fig. 5 are plotted cylinder-wall reactions against the piston throughout an engine cycle for a passenger-car engine *without* offset piston pin, under full throttle at moderate speed—these being the engine operating conditions most conducive to slap. In determining the reactions corresponding to different crank angles, account was taken of both the gas pressure and the inertia force. The total reaction was divided into two items, acting at the top and bottom end of the skirt, respectively, and in determining the respective values of these items account was taken of friction in the piston-pin bearing. Points where the curves intersect the base line correspond to crank positions at which the piston leaves the side of the cylinder against which it has been bearing, and the steepness of the curves at these points is a measure of the rapidity of change of the reaction, and therefore of the impact or slap against the cylinder wall. From Fig. 5 it can be seen that the impact is most intense at the beginning of the power stroke, and in making a study of the effects of various factors on piston

slap, the other portions of the cycle can be disregarded.

In the experimental investigation of the effects of piston-pin offset on slap, the offset was varied in steps of 1 mm (0.04 in.) from −3 mm (0.12 in.) to +3 mm, the plus sign here indicating that the offset is toward the pressure side of the piston.

In Fig. 6 the crank angles at which pivotal motion of the piston around the bottom edge A and the top edge B of the skirt begins are plotted against the offset. When the force B with which the top end of the skirt presses against the cylinder wall drops to zero, motion begins around the bottom edge B, and vice versa. Figure 7 in the same way shows when these pivotal motions come to an end. That the points of intersection of the two curves in each figure do not lie on the vertical line for "no offset" is ascribed to the influence of piston-pin bearing friction.

It was found that for this engine an offset of + 0.12 in., which is practically three per cent of the piston diameter, is the optimum, hence the piston transverse movements for such an offset are of most interest. From Fig. 6 it can be seen that with this offset the piston begins to pivot around the top edge of its skirt at about 52 crankshaft degrees before top center, and ends the pivotal motion about 12 deg before top center. Thus the lower end of the skirt comes in contact with (or approaches closest to) the pressure side of the cylinder shortly before top center, the pivotal motion extending over 40 deg of crank travel. The pivotal motion around the bottom edge of the skirt (which now rests on the pressure side of the cylinder) begins 15 deg past top center, and comes to an end 32 deg past top center, hence it extends over 17 deg of crank travel. Both pivotal motions are equal, and since that around the lower edge is accomplished in less than one-half the time, the impact of the top end of the skirt on the pressure side of the cylinder is considerably greater than that of the bottom end. However, in each of these two cases the impact is softened by the fact that it occurs on the trailing end of the piston. The latter then acts as a slipper bearing (Michell thrust bearing), in which a wedge-shaped oil film is maintained that cannot be easily disturbed. From Fig. 7 it can be seen that the impact of the bottom end of the skirt occurs 12 deg ahead of top center, when the piston is moving in the upward direction, and the impact of the top end 32 deg past top center, when the piston is moving downwardly.

Conditions are the exact opposite when the piston pin is offset toward the "off" side of the piston. With the same offset of 0.12 in. the top end of the skirt is first to move over from the "off" side to the pressure side, and hits that side slightly before top center, while the piston is still moving upwardly. Under these conditions the piston evidently tends to scrape the oil off the cylinder wall and to permit metallic contact between it and the cylinder, but because the impact occurs so near the top center, when the angularity of the connecting rod is very small, the force of the impact is small. The lower end of the piston, on the other hand, hits the pressure side of the cylinder wall only about 62 deg past top center, when the piston is moving downwardly at great speed and when, on account of the great angularity of the connecting rod, the side thrust is quite high. The oil film is then scraped off the cylinder wall and metallic contact results. This, then, is the part of the cycle at which there is most likely to be audible side slap. It is for this reason that offset of the piston pin toward the pressure side of the piston is preferable.

Fig. 8

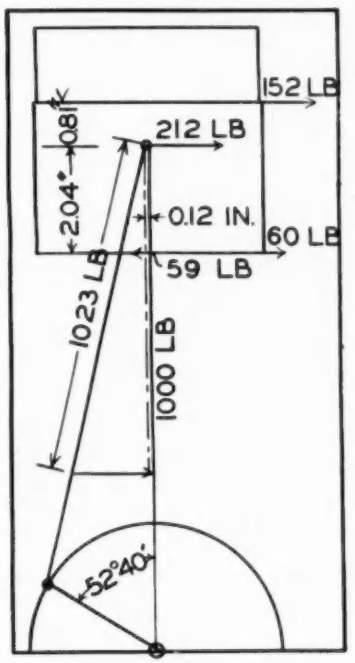


Fig. 8—Crank position and relative forces at moment when pivotal motion around upper edge of skirt is about to begin.

In Fig. 8 are represented conditions in an engine with an offset of 0.12 in. toward the pressure side, at the moment when the bottom end of the piston skirt leaves the "off" side of the cylinder. As stated previously, the cylinder bore is 4.2 in. and the stroke 4.6 in. The connecting-rod length has been assumed to be 8.25 in. and the distances of the piston-pin axis from the top and bottom ends of the skirt are taken to be 0.81 in. and 2.04 in., respectively. Since the piston-pin axis is offset 0.12 in., the engine will be in dead center when the crank makes an angle of 40 min with the vertical; and at 52 deg ahead of top center, when the bottom end of the skirt leaves the "off" side of the cylinder, it will make an angle of 52 deg 40 min with the vertical. For that position of the crank the connecting rod angle is 12 deg with the vertical.

Since all forces and moments are directly propor-

(*Turn to page 73, please*)

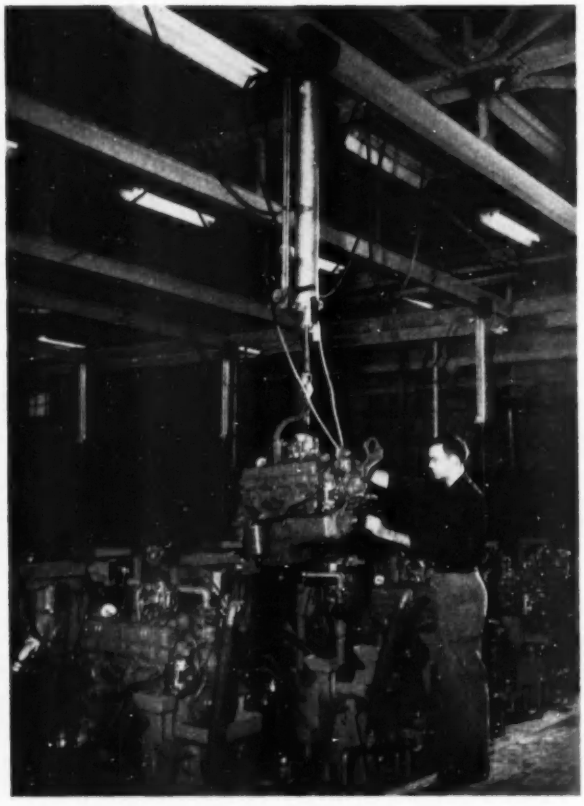
Materials Handling Automation

has vital role in

BUICK V-8 Production

PART II

By Joseph Geschelin

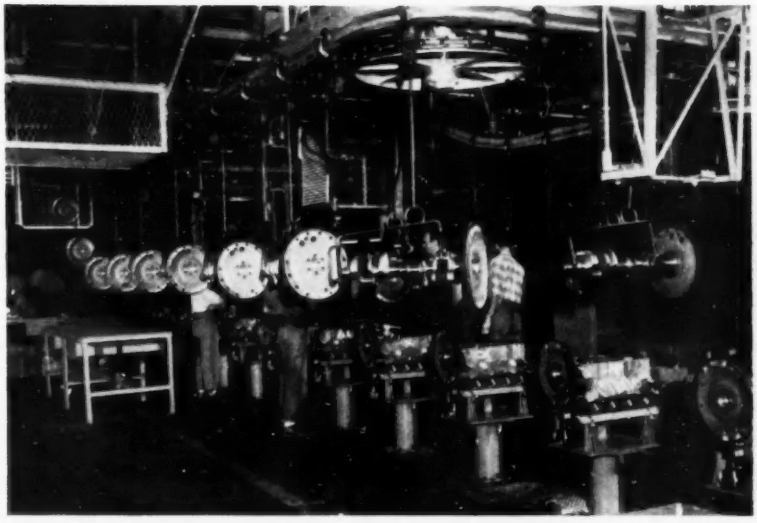


Closeup at left is one corner of the extensive facilities for block testing of engines. This view was posed deliberately to highlight the means for handling engines in and out of the blocks. It is done by means of Curtis air cylinders which travel on the overhead rail over each row of test stands. The air hoist is employed also for removing engines from the conveyor line feeding this department.

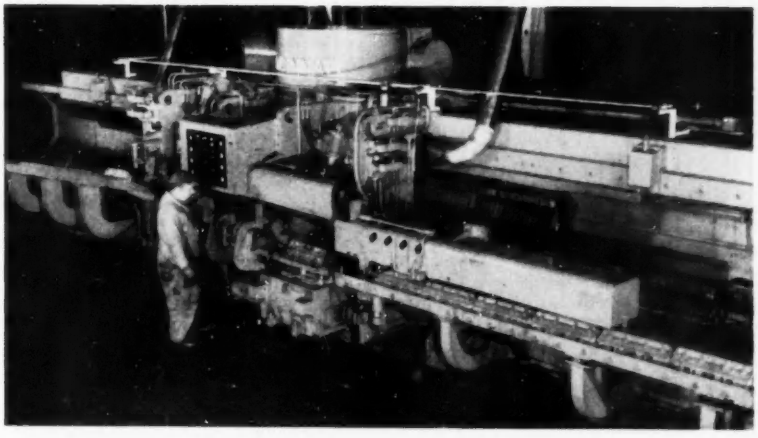
FOLLOWING Announcement of the Buick V-8 Engine for 1953 the First Article Dealing With Some Selected Production Highlights Appeared in Automotive Industries, February 1, 1953. This Second Article Deals With Further Innovations in Production Utilized at Buick's Modern Engine Plant.

MATERIALS handling has been organized to the maximum extent and may be expressed in terms of miles of conveyor systems for assembly lines, monorail conveyors feeding work within departments, and conveyor systems transporting parts and sub-assemblies to the final assembly lines. In addition, there are specialized conveyor systems such as the heavy-duty line in the crankshaft department, installed by Mechanical Handling Systems of Detroit. Cranes and hoists complete the picture, all being designed to reduce manual handling and keep supply lines filled in accordance with demand.

One of the interesting features of materials handling is the use of the versatile Curtis air hoists. Installed in the engine test area, the hoists are employed for removing engines from the



At left is one of the sections of the engine final assembly line. Attention is drawn to the pedestal type assembly fixture, designed to permit rotation of the engine in any desired position. Of interest too is the overhead conveyor system feeding parts and subassemblies to the final line. It is part of a comprehensive system of materials handling installed in this plant.



Cincinnati surface broaching machines for finishing cylinder heads are becoming bigger and more massive as above view shows. The Buick cylinder head has more surfaces to finish than is usual, hence the impressive array of cutting tool blocks on an enormous ram.

feeder monorail conveyor and transferring them in and out of test blocks. They are used also for transferring engines into and out of the GMR balancing machines.

The final assembly line conveyor system is one of the most modern to be found in this industry. As illustrated, the floor conveyor contains low pedestal type fixtures on which the engines are built. These pedestals can be positioned with 360 deg of freedom, thus facilitating all assembly operations. Another feature of this type of assembly conveyor is that operators can work freely about each stand, thus permitting a large number of operators to be stationed at certain locations without interfering with one another.

While on the subject of the engine assembly, it will be recalled that in the first article it was mentioned that cylinder bores were graded in 10 sizes on the cylinder block line. At the start of engine assembly, there is a Telautograph station communicating directly with the sub-assembly of pistons and rods. At this point an operator notes the grade for each bore of a specific block and transmits this information to the piston assembly station where pistons of proper size are selected to suit a given block. As usual, the set of selected pistons and rods will meet the engine at the proper assembly station.

Following assembly, engines are tested 100 per cent in the block test department. This in itself is an extensive operation, and includes some 240 test stands. After the block test, accepted engines are transported to one of a group of special GMR balancing machines for balancing the completely assembled unit. These machines are designed to check dynamic balance at both ends and are provided with a drill head for drilling suitable balance holes in the engine flywheel. Balancing is a 100 per cent operation, achieving balance within narrow specified limits.

Special attention has been given to the most effective and most economical means of chip disposal. All of the cast iron machine lines, where cutting is done dry, have a chip conveyor built directly into the floor under the machine lines. These individual chip conveyors terminate in a central chip conveyor which transports the chips to a large hopper. An elevator-type conveyor then carries the chips to an overhead hopper from which they are dumped directly into cars for delivery to the Buick foundry.

Departments handling machining of steel parts and non-ferrous parts, on the other hand, where cutting fluids of various types are used, are served by individual centralized coolant systems, having settling tanks, and means for filtering cutting fluid for reuse. (*Over*)

Machining of the intake manifold is noteworthy from the standpoint of advance product planning as it affects an important machine installation. It is of interest that the 16-station Snyder transfer machine which completes all operations is tooled to handle three different manifolds—for the Super, Roadmaster, and one other. Consequently only a limited number of the machine heads are in action at any time, the control unit being designed to select these heads in accordance with the part number running at any given time.

The 16-station Snyder transfer machine is tooled for the following operations—drilling, milling, spotfacing, countersinking, core-drilling, and tapping. For a selected part number the machine has 48 spindles in action and eight stations in actual operation.

An interesting feature of this machine is the grouping of inclined heads to facilitate machining of the inclined top surface of the manifold.

Only one other operation is done on the manifold outside of the Snyder unit and that is the milling of the joint faces. This is handled in a three-station Kearney & Trecker mill which rough and finish-mills to provide finished faces. Milling is done with cemented tungsten carbide tipped blades, the finishing cutter being of Shear Clear type.

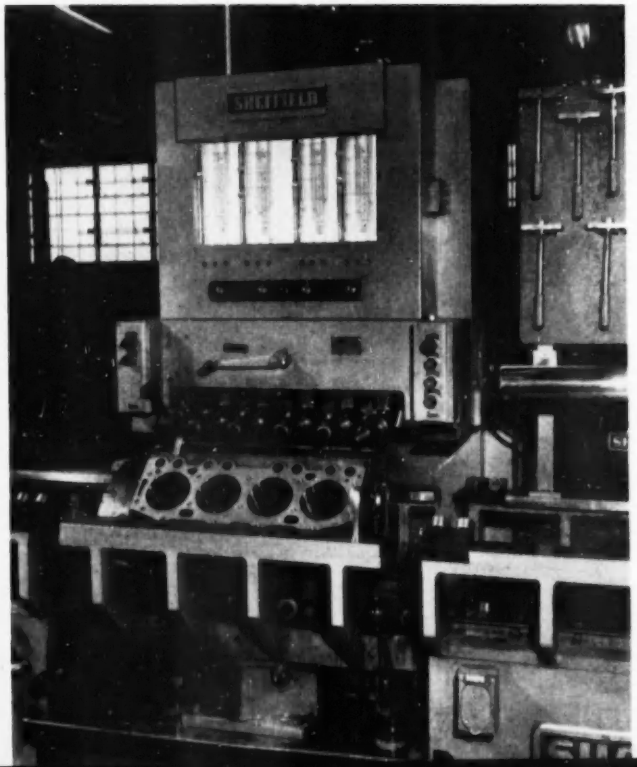
The cylinder head is machined in two major stages—first starting with the rough casting, then as a sub-assembly with valve guides. Machining starts with surface broaching of angular faces, gasket face, groove, and a locating pad in an enormous three-station Cincinnati surface broaching machine. Although similar to the machine installed in the old engine plant some time ago, it is somewhat larger and more massive, with a considerably larger ram and a greater number of individual carbide tools.

Next in line is a 15-station W. F. & John Barnes progress-through transfer machine, and a 15-station Footburt special transfer machine for the same operations—drilling, reaming, spotfacing, milling, and chamfering. These machines have 107 spindles in action in this cycle.

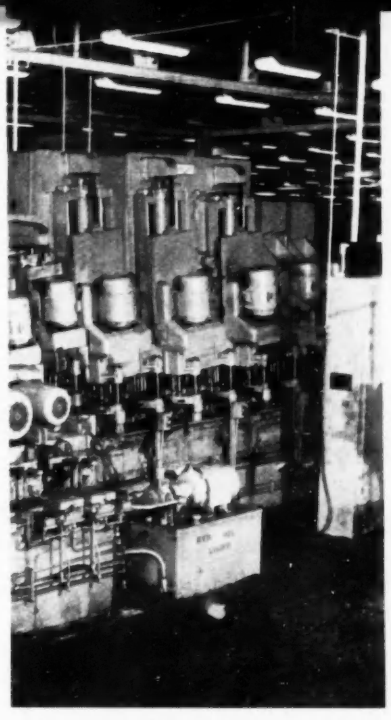
The compact Snyder transfer machine, seen here, completes the machining of intake manifolds in one cycle. The machine handles three different manifolds, uses only a portion of the heads for any given

At the end of the cycle, the cylinder head enters a special Cincinnati profile milling machine for rough- and finish-milling of combustion chambers which are finished all over to achieve uniformity of volume. This machine has four spindles with a special tracer control for roughing and another for finishing; also separate profile templates for rough and finish-profiling. Milling cutters for these operations are tipped with cemented tungsten carbide blades.

The next stage again has a group consisting of a W. F. & John Barnes progress-through machine and a Footburt transfer machine, each one having 13-stations. These machines handle another group of drilling, counterboring, chamfering, reaming, core drilling, and facing operations. Each machine has 72 spindles in action. Station 4



Familiar Sheffield Precisionaire column type gage for grading cylinder bores. Two of these are found at the end of the machine line, one for each bank. The tolerance bands for the ten grades discussed in the text may be seen here.



part number. From a design standpoint it is of interest that the heads and tools are inclined with respect to the fixtures and conveyor. This is done to compensate for the inclined faces of the work.

is used for tumbling the work to remove chips, while four stations are idle. Station 13 is for tumbling to remove chips and unloading.

Another pair of transfer machines—13-station W. F. & John Barnes and Footburt units—handles the following operations—rough - reaming, finish - reaming, drilling, chamfering, and tapping various holes, including angular holes—for valve guides, exhaust manifold studs, water outlet holes, etc. These units have 87 spindles in action. They have three idle stations and one for tumbling to remove chips.

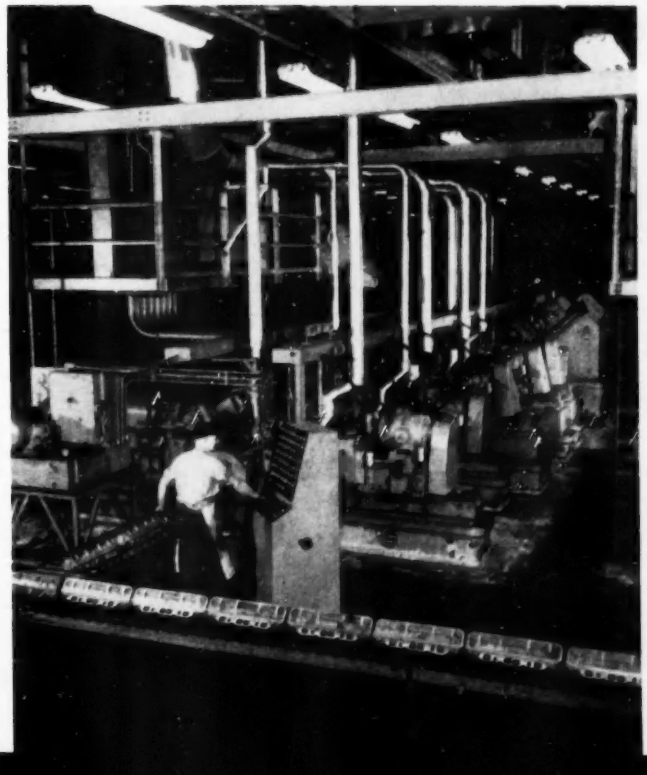
The second phase of cylinder head machining is concerned with completing the sub-assembly which includes inserted valve guides. This job is done in a 17-station W. F. & John Barnes transfer machine, the fourth unit of the same make on the cylinder head line. It includes a special Colonial horizontal assembly press for automatically pressing-in the valve guides. Operations on the transfer machine include the following essentially valve line operations—boring valve-guide holes, finishing valve throats, reaming valve-guide holes, pressing-in valve guides, finishing valve seats, and reaming the valve guides. This transfer machine has 46 spindles in action. Three stations are idle; three stations are designed to roll the work 90 deg, turning the work automatically to suit the next operation. Station 9 is fitted with eight wire brushes to clean and condition the reamed bores for the valve guides prior to pressing-in the bushings.

Final major operation is finish-broaching of the gasket face in a special Cincinnati horizontal tunnel type surface broaching machine. This is done after all machining stages have been completed, to provide a fine gasket surface, finished to size. At this point the heads go through a Blakeslee alkali washer for thorough cleaning and are ready for 100 per cent inspection.

Considering the volume of production, the cylinder block machine line is unusually compact and economical of floor space. This may be attributed to the adoption of transfer machines for the majority of operations. In its final state, about the time this article is in print, the first operation will be handled in an enormous Cincinnati horizontal type surface broaching machine, finishing the cylinder banks, crankcase parting line, and main bearing locks in one pass. Details of a sampling of transfer machines follow.

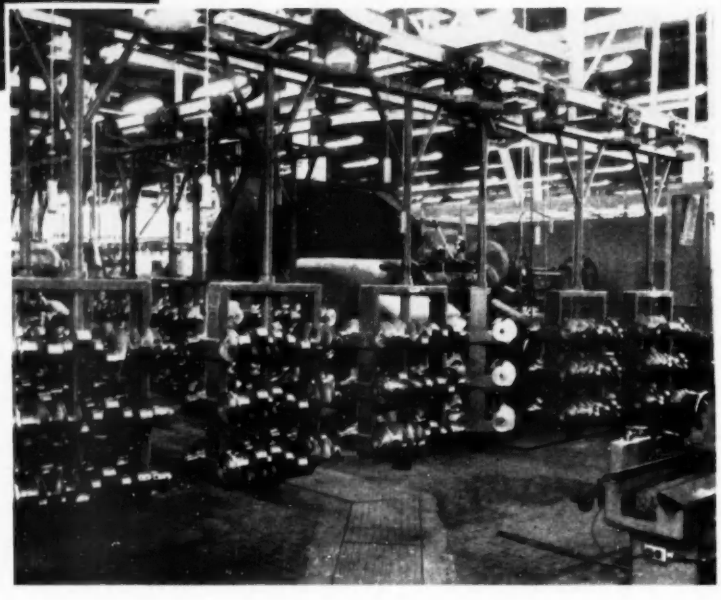
Drilling, chamfering, reaming, and tapping of all holes in front and rear ends of the block are done in a special W. F. & John Barnes 27-station transfer machine. This machine has 144 spindles in action, including a number of boring bars. It has 10 double stations idle, and one single station idle.

Drilling of holes in top and bottom, including the drilling of odd pad holes, welch plugs, and milling of bearing locks, is handled in a 19-station Footburt transfer machine. In the first station the block is rolled 90 deg bringing the pan rail to the right. At the 13th station the block is rolled 90 deg again to bring the



An interesting perspective of one of the sections of the W. F. & John Barnes transfer machine on the cylinder head line. Seen here are the loading station and control panel in the foreground; exhaust ducts leading from each head; and the compact overhead arrangement of wiring for the machine.

Perspective view of a section of one of the several Greenlee transfer machines on the cylinder block line. Note particularly the accessible mounting of driving motors for each head; and the fixed conduit and duct installation for carrying power to each individual head.



This view, taken in one corner of the V-8 crankshaft machining department, shows the conveyor system for transporting work. As shown, the shafts are carried in special heavy duty carriers holding six pieces at a time. The conveyor system in this department, as well as in other departments, was installed by Mechanical Handling Systems of Detroit.

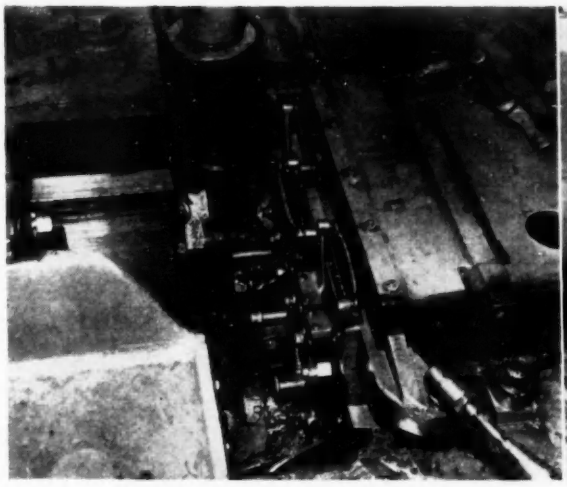
pan rail up for operations on the sides. The machine has a total of 143 spindles in action. It has four idle double stations.

An 18-station Greenlee transfer machine is tooled on this line for drilling and semi-finish reaming valve lifter holes, drilling angular oil holes and oil filter mounting holes, starter bore, and equalizer holes. The block is loaded at the first station with pan rail up—as it comes from the previous operation—then it rotated 180 deg to bring the pan rail down. This machine has 75 spindles and four idle stations. At Station 7 the block is rolled over 360 deg to clear chips.

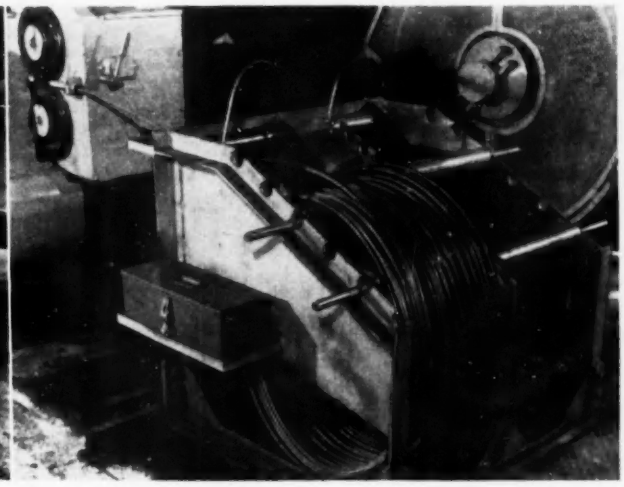
A second Greenlee transfer machine, having 19 stations, is tooled for drilling and tapping holes in both banks and the sides of the block; semi-finish and finish-reaming valve lifter holes. This operation is performed with the pan rail down. The machine has 188 spindles at work. Station sequence is quite complicated, subject to automatic control. There are four idle stations, and one station for gaging. The 16th station has a rollover of 90 deg to carry the pan rail to the left. At the last station the block is rolled 90 deg once more to have the pan rail up to suit the next operation.

In the next machine, a 15-station Natco transfer unit, the block is moved with pan rail up and with the rear end to the right to facilitate boring operations. The work in this machine includes rough-boring the front, center, and rear center cam bearings; machining oil slinger grooves; finish-facing and chemfering the rear main bearing. This is a double-index type machine, holding two blocks in adjacent stations for the same operation. Is is equipped with 14 boring bars and has three idle stations.

A nine-station Natco transfer machine follows in line for semi-finish-boring of the cam and crank line.



First upsetting operation in the dies.



Steel wire is fed from an uncoiler to the bolt making machine.

Steel Valve Tappets Made by Cold Heading

Successive cold forming steps in production of the new valve tappet.

WHEN Ford Motor Co. changed to overhead valves for the six-cylinder engine for its passenger car line, it was necessary to design valve tappets for the new engine. These are ordinarily of gray iron, cast to shape and machined to size. Ford engineers decided, however, that the shape of the piece and its other requirements might permit the use of steel, and a cold-forming operation. A program of study and development now has produced a steel valve tappet formed in several steps in one machine, and finished by grinding.

The valve tappet is made as a solid steel stem, socketed at one end and with a disk head at the other. The head is crowned slightly over the top. The piece is formed from ½-in. cold rolled steel, fed to the cold heading machine from a coil. Wire of type 5120 steel is used. This is believed to be the first time tappets for automotive engines have been produced by cold heading.

The process begins with cold drawn 0.499-in. wire in coils. The stock is fed to a ½-in. National Boltmaker from an uncoiler, and is cut off to length at the dies. The blank then moves to the first heading station, where at the first blow the initial upset is made at the head end and a ball punch semi-forms a recess in the socket end. Automatic fingers next transfer the piece to the second heading station. Here the upsetting is completed, with a 0.183-in. radius remaining under the head, and the socket is finish formed to close tolerance. The final station in this die trims the circular head to size, removing the flash left in the second heading. The next station chamfers the small end of the piece.

All of these operations are, in general, similar to those in standard bolt making. The next operation in the standard bolt-making machine would be the transfer to the thread-rolling dies. Threads are not required for the tappets, but the pieces are similarly transferred and a roll die forms an annular recessed groove under the head. The groove is 0.007 in. less than the stem diameter, and so could not be produced in the heading dies. It provides grinding clearance when the stem of the tappet is given a finish grind. The formed tappets are then discharged through a chute into tote drums.

A result of the upsetting is that the stem of the tappet has increased in diameter from 0.499 in. to 0.510 in., and the head to about 1.040 in. The head is trimmed to about 1.015 in. in the final heading operation. The stems are rough ground, and the heads are crowned to a maximum of 0.002 in. by honing, grinding, or machining.

The tappets are carbonitrided at 1650 F for 12 hr to obtain a case depth of 0.40 to 0.060 in., with 0.003 to 0.004 in. of carbides as cementite. The atmosphere

(Turn to page 87, please)

An Aircraft Designer Analyzes

By Norman C. Parrish,
Design Research Engineer
Structures Technical Staff,
Northrop Aircraft, Inc.

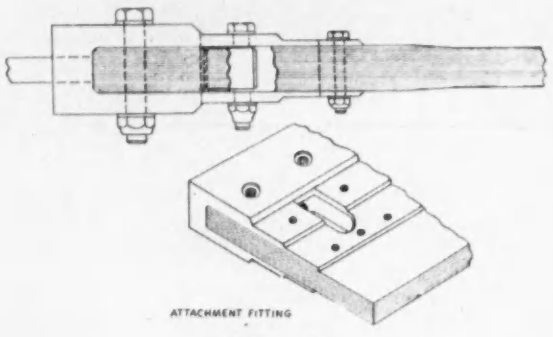


Figure 1

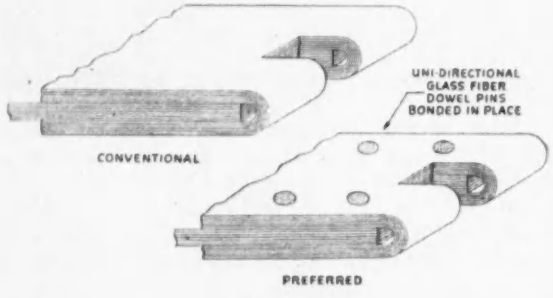


Figure 2

THE higher mach number flights for aircraft have brought to immediate attention three important considerations: (1) the physical properties of current production material at elevated temperatures; (2) the producibility of material having acceptable elevated temperature properties; and (3) low cost. It is readily recognized that a new material is required to fulfill the planned design parameters demanded by high production requirements and the contemplated elevated temperatures. A basic requirement of this production material is not necessarily low density, but such a material would be most desirable. The possible adaptation of a low density, low cost material for structural application is discussed in this article.

As the result of studies at Northrop Aircraft, Inc., on both aluminum and magnesium alloys, it is apparent that the present alloys of these materials would not be structurally satisfactory at contemplated elevated temperatures. When these alloys of aluminum and magnesium are plotted on a stress strain diagram at elevated temperatures, it is noted that the rapid decrease in the elastic modulus and other physical properties will prevent their further consideration until new alloys are developed.

When the 300 F service conditions are considered, the review of the various alloy steels indicate that in each case a new set of circumstances, with its own set of problems, presents itself to the designer. In order to properly maintain buckling stability, it is generally necessary to have the skin thickness of a specific gage metal considerably greater than would be necessary for strength alone. The higher density of the usable ferrous alloys presents an undesirable weight problem when buckling stability is maintained. This resultant weight penalty stimulates an intensive investigation of the properties of plastic bonded glass fiber reinforced laminates.

Reinforced Plastics

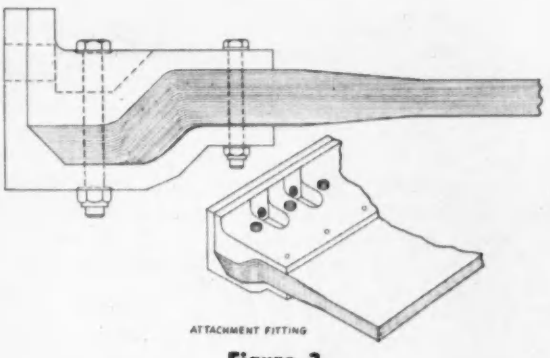


Figure 3

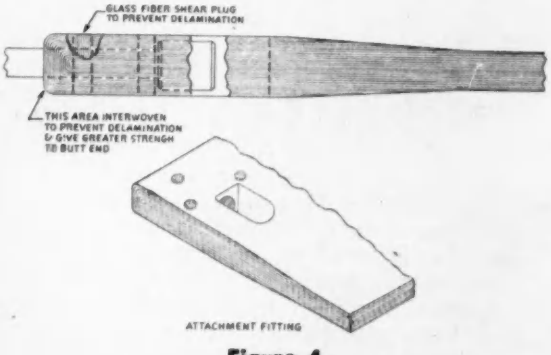


Figure 4

When considering plastic bonded glass fiber reinforced laminates, the glass fiber strands cannot be considered independently by the designer. The plastic binder and fillers must also be considered at the same time. Even though the main structural properties are dependent upon the size, direction and type of glass fiber strand, the percent of plastic binder affects the strength and resultant elastic modulus of the composite material. This inherent characteristic of the reinforced laminate can be predetermined by the designer and thereby advantageously used as a powerful tool to reduce stress concentrations. This must be considered constantly to avoid being penalized by the absence of yield point characteristics. The stress-strain curve drops off abruptly from the proportional elastic portion in such a manner that the proportional limit is nearly coincident with the point of ultimate strength.

When structures are desired that have as a basic requirement shock absorption, the characteristics inherent in plastics are most desirable. When a structure can tolerate deformation by shock, but not permanent set, this property of no yield point is again a very desirable characteristic. Also by proper designing techniques, not necessary with reinforced plastic materials of an isotropic nature, the unique properties of orthotropic glass fibers need not be a handicap for prime structures. These design techniques were developed and investigated at Northrop Aircraft, Inc., in an effort to obtain desirable effective physical properties while sustaining low cost and, in many instances, weight reductions.

The plastic bonded reinforced structure was studied to determine what it had to offer. Glass fiber reinforcing material was promising in three major arrangements: the unidirectional warp; random fiber mat; and a number of woven cloth patterns. From these materials a wide variety of selections can be made to best suit design requirements. In the actual selection, the most suitable glass fiber reinforcing material must be made only after a careful consideration of its specific application is completed. The bonded random mat, or mascerated roving material, has a lower elastic effective modulus and strength, but it also has more uniform properties in all directions. If a specific directional property is required, a selected woven unidirectional cloth or unidirectional warp is most suitable.

When more than one specific directional value of stiffness or strength is required, the designer should avail himself of polar-coordinate charts for each cloth. These charts present the configuration of the directional properties of the various weaves showing comparative properties. A set of such charts has been published by Owens-Corning Fiberglas Corp., Newark, Ohio, as well as numerous other firms that are making independent studies of structural properties of test

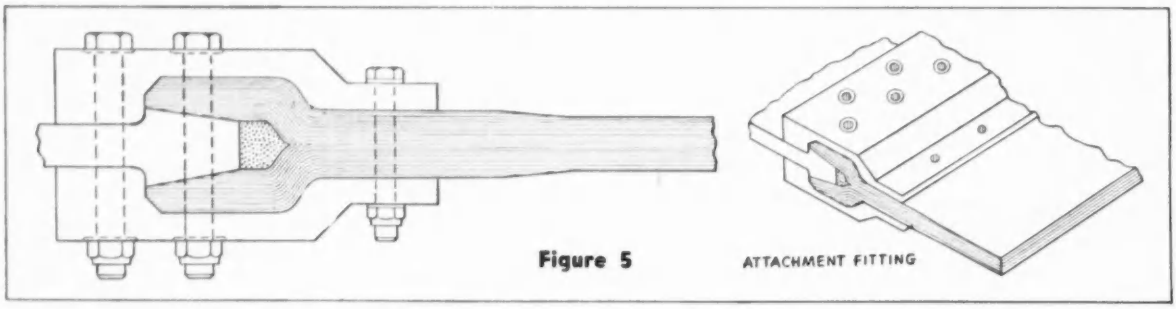


Figure 5

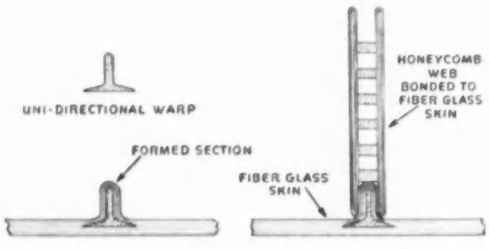


Figure 6

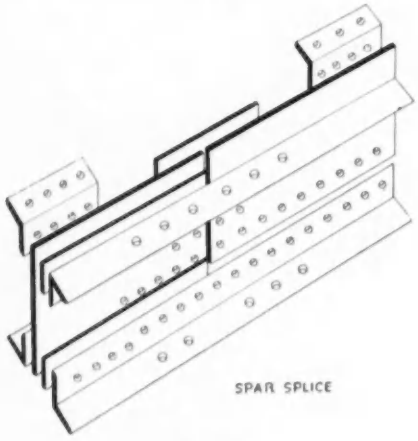


Figure 7

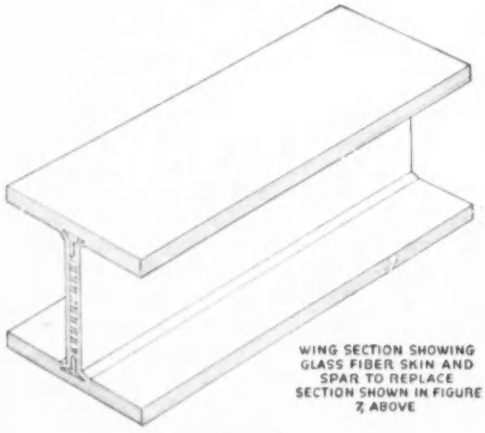


Figure 8

specimens for their particular applications.

There are some filler materials that can be used to increase strength, but in each instance such a filler also increases the weight.

When maximum properties are desired in one direction only, the unidirectional warp is most desirable. This unidirectional material enables an elastic modulus to be used that may be three times that obtained by some of the woven cloth mats. The properties of unidirectional warp can also be advantageously used by the selective arrangement of lay up during the fabrication of the composite part. This arrangement should also be considered by comparison of polar-coordinate charts that have been plotted from test data.

The maximum benefit cannot be obtained from plastic reinforced laminates unless the laminate is considered in conjunction with its "running mates," honeycomb, and foamed low density plastic. These materials have properties that make them excellent weight savers and can, in many instances, adequately carry relatively high compressive shear loads. These honeycomb structures and plastic foam materials are available to the designer in a variety of densities and strengths for properly matching the load requirements. The problem of attaching these structures to the glass fiber skin is more of a process problem than a structural one, for numerous cements are available, and comparative data is available from the manufacturers' on their specific properties. Tests made in the Northrop Aircraft Process Laboratory indicate that bonding agents for attaching formed plastic material are available with higher strength properties than the internal strength of the foamed plastic. When the higher range of elevated temperature service (near 300 F) is required, the list of available materials narrows down rapidly. However, suitable bonding material can be obtained.

As the process techniques are developed and the physical properties of the structural configurations improve, the number of applications of plastic reinforced laminates to primary structure naturally increases.

The design techniques indicated in this article

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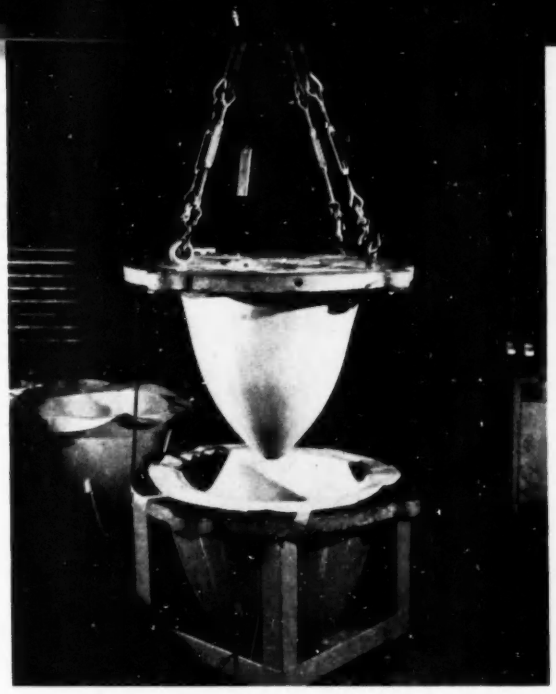

Fig. 1—Dies used for forming radomes.

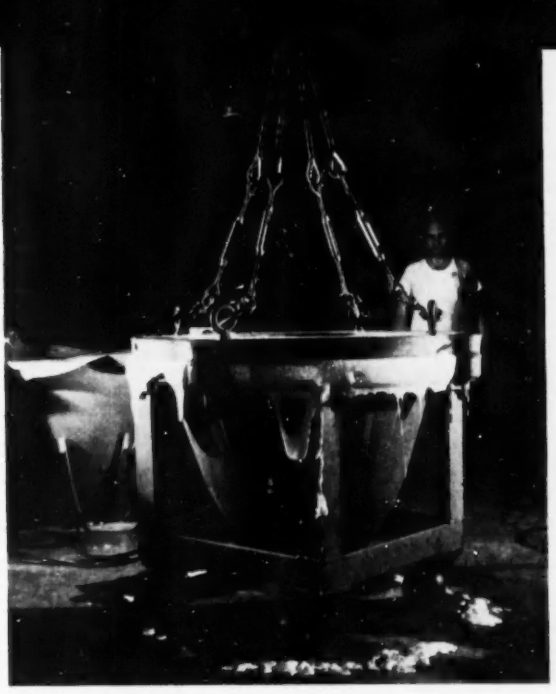

Fig. 2—Lockfoam seeps over edge of die after foaming has been completed.

Lightweight Foamed Plastic

Strengthens Aircraft Components

ILLUSTRATED here are two applications of Lockfoam—a new, lightweight foamed plastic—at the Lockheed Aircraft Corp. in Burbank, Calif.

Fig. 1 shows the dies used to form radomes for the Lockheed F-94C Starfire ready for pouring liquid Lockfoam. Laminated glass-fiber cloth outer and inner linings are in place. The dies are heated to 120 F in an oven to give proper rise while foaming takes place. During the foaming reaction, Lockfoam will produce heat greater than 200 F.

After foaming has been completed, Lockfoam seeps over the edge of the die as shown in Fig. 2. The dies stay together for eight hours of curing; six hours at 200 F and two hours cool.

When curing has been completed, the upper (punch) die is raised with the hardened radome adhering to it. Finally the foamed radome is carefully removed

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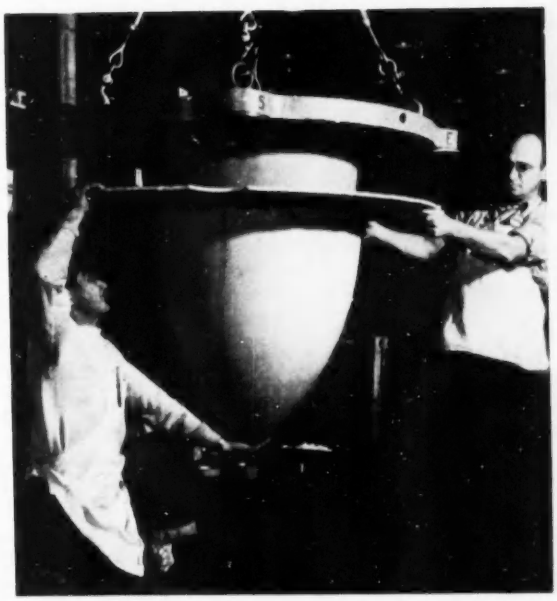


Fig. 3—Removing radome from punch die.

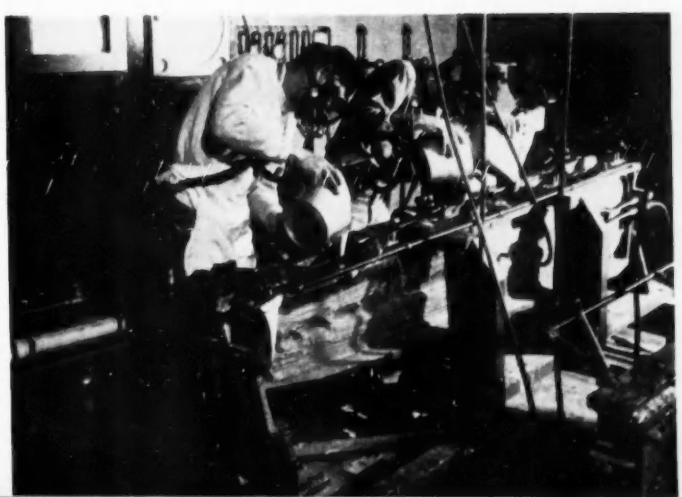
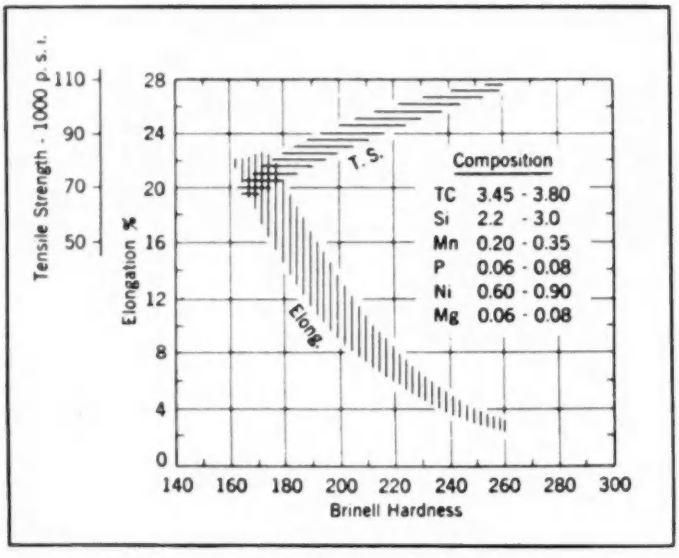


Fig. 4—Pouring Lockfoam into an aileron section.

Ductile Iron Applications E-x-p-a-n-d



Relationship between tensile strength, elongation, and hardness of ductile iron.

DUCTILE iron, although introduced to the foundry and metalworking industries on a commercial basis just a little over three years ago by the International Nickel Co., has made remarkable strides since that time. In 1949, the first year of commercial production, just 3500 melt tons were poured, but in 1950 this figure soared to 20,000 tons. The year 1951 saw over 50,000 tons turned out, and the figure for 1952 is estimated at 80,000 to 100,000 tons.

A further indication of the growth of ductile iron is found in the fact that at the present time there are approximately 200 firms in the U. S., Canada, and abroad operating 500 to 600 foundries licensed to produce it. Castings range from those weighing a few ounces, with sections as light as 0.1 in. thick, to 50-ton anvil blocks having sections 48 in. thick. The automotive and hundreds of other industries are finding more and more uses for ductile iron in numerous applications.

A high carbon ferrous product, ductile iron contains graphite in the form of spheroids. This arrangement of the graphite particles reduces internal notching considerably and greatly increases the proportion of effective matrix structure.

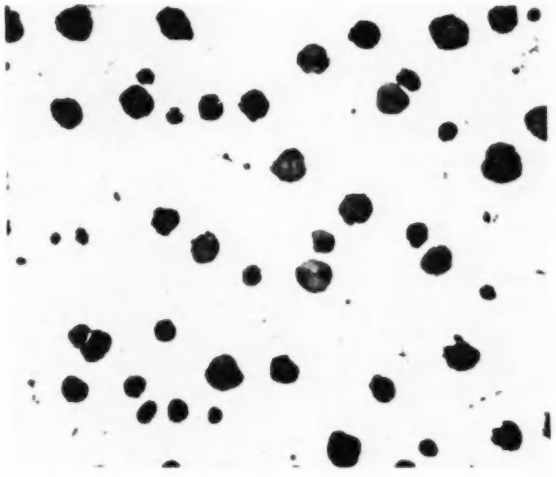
It should be pointed out that the small quantity of magnesium, which is introduced into the molten metal before pouring, controls, in a broad sense, the graphite form and has relatively little effect on the matrix properties. These are primarily controlled by the hardening elements, such as silicon, manganese, nickel, molybdenum, chromium, or other carbide-forming elements, the cooling rate of the casting in the mold, and the phosphorus level.

Since ductile iron can be produced in the cupola, it has a broad flexibility with respect to the size, intricacy, and number of castings that can be produced at a given time. Compositional limits are quite broad, a wide variety of materials can be used for the base iron, and castings which may not meet required specifications in the as-cast condition can be simply heat treated to fulfill the exigencies of the situation. Its fluidity, suitability for pressure castings, and lack of "hot tearing" contribute to ease of production.

Aside from its ductility and general strength, ductile iron is winning special approval for its high resistance to mechanical wear in both lubricated and unlubricated conditions. It is claimed that the metal may be flame or induction hardened to 550 to 600 Brinell. Other important assets of ductile iron are: heat and oxidation resistance at high temperatures; fatigue resistance; yield strength in combination with toughness; ability to withstand shock loads; weldability; and machinability.

Ever alert to the advantages which a new engineering material may have to offer, the automotive industries were among the first to experiment with ductile iron castings in all types of applications. Cams, gears, sprockets, and bearings were some of the automotive parts to be cast initially in the new metal, and the list of uses for ductile iron castings in the automobile, aircraft, marine, farm equipment, machine tool, etc., fields has grown steadily ever since.

The extent to which ductile iron has penetrated the aforementioned industries was graphically demonstrated in a display of equipment which International Nickel recently showed to the technical trade press. For example, a Ford trench hog on display incorporated sprockets, cutter holding brackets, counterdrive



Typical microstructure of ductile iron showing spheroidal arrangement of graphite particles.

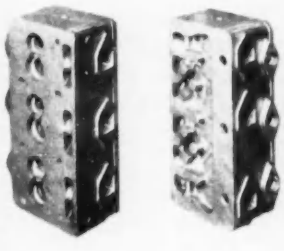
support bracket, sleeve, and cleaner blades of ductile iron. Similarly, a garden tractor nearby had a pawl carrier and tool raising lever cast in the metal.

Automotive crankshafts are becoming steady favorites for the use of ductile iron castings.

In combination with a precision casting method, such as the shell molding process, large savings in material and machining time are achieved. A sample of them was on display at the exhibition in the form of a crankshaft for a Le Roi truck engine.

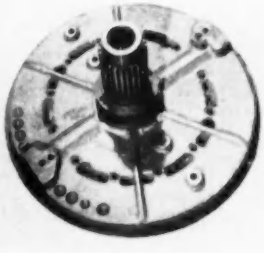
Other parts shown that were cast from ductile iron were: cylinder blocks; piston rings; gear wheels; hub and brake drum; camshafts; clutch adjusting nut; marine gear; axle pivot housings for a road compacter; tank turret lock assembly; Borg-Warner clutch drive ring; Firestone tire mold; components of a DoALL band saw; and a fan hub. A particularly interesting aircraft part on display was the outer ring (made by American Brake Shoe Co.) of a main bearing support for a Sapphire jet engine.

Typical Automotive and Aviation APPLICATIONS of Ductile Iron



Diesel engine head.

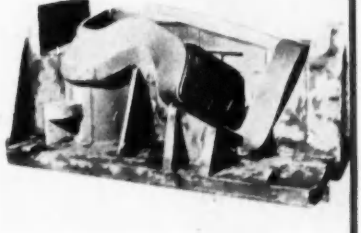
Diesel engine pistons.



Clutch plate for heavy-duty tractor.

Combination automobile hub and brake drum.

Fixture castings for jet aircraft.



Automobile fender die.

Possibilities for Weight

RECENT data on possibilities for weight-saving in highway vehicles, control with power hydraulics, and research procedures and results were discussed at the recent SAE National Transportation Meeting in Pittsburgh. About 300 engineers and fleet operators heard some interesting papers, three of which are abstracted here. Two papers point out areas for building lighter trucks and tractors, while a third illustrates some bench-testing techniques for components.

Weight Reduction of Power Driven Highway Vehicles

By J. N. Bauman
White Motor Co.

THE economics of motor transport are tied into payload that can be carried. The cost per day of an intercity tractor trailer transport unit will approximate $75 to $100 per trip on a 350-mile run. This total cost will not change with a wide variation in payload. As a result, a transport unit which due to its design can carry 2500 lb more payload per trip than one not so designed, will be a much more economical and profitable unit. The best known approach to greater payload with limited axle weights and total allowable weights is by the use of light metals.

The question as to the point of application where substitution of light weight metal is economical must be determined by its contribution to lower cost to the truck user. As an example, based on carrying full additional payload on every trip, the estimated weight saved by aluminum substitution on a tractor might be 700 lb at an additional cost (at $.60 per lb) of $420, or $600 selling price. If additional revenue at $.80 per 100 lb for a 350-mile trip is $5.60, additional revenue per mile is $.016, and the mileage to just get back additional investment is approximately 40,000 miles.

The data furnished in Table 1 were prepared by the Aluminum Co. of America and show the relative cost per lb for weight saving by the use of aluminum in various design components. It is interesting to note that it varies from $.75 per lb on some parts

TABLE I
Cost of Saving Weight On Aluminum Alloy Chassis Parts

Item	Cost of Wt. Saving/Lb Saved
Forged spoke wheels (dual trailer)	20¢
Forged spoke wheels (dual truck)	35¢
Forged spoke wheels (single front)	40¢
Forged disc wheels	65¢
Sand cast spoke wheels (dual trailer)	25¢
Sand cast spoke wheels (dual truck)	40¢
Sand cast spoke wheels (single front)	60¢
PM cast spoke wheels—Use forged spoke wheel figures:	
Spring hangers—220-T4	50¢
Spring hangers—356-T6	40¢
Frame cross members—220-T4	50¢
Frame cross members—356-T6	40¢
Rear axle housings:	
Timken style with closed bowl	76¢
Eaton style with open banjo	32.5¢
Hubs:	
Forged trailer dual	20¢
Sand cast trailer dual	40¢
PM cast trailer dual	20¢
Forged truck dual	30¢
Sand cast truck dual	65¢
PM cast dual	30¢
Forged truck single	33¢
Sand cast ruck single	70¢
PM cast single	33¢
Brake Shoes (Compare with malleable):	
Rear sand	25¢
Rear PM	10¢
Front sand	35¢
Front PM	15¢

Reduction in Trucks . . .

to as low as $.18 per lb on others. This comparison immediately shows the designers where substitutions can be made to maximum advantage cost-wise.

There is, however, an additional approach to the problem of designing motor truck equipment so that it can carry more payload. This approach considers the design of the chassis itself in terms of load distribution that will permit maximum weight on the king pin of a tractor within legal axle and total GVW limitations.

The cab forward type of tractor, provided it gives the proper type of tare weight distribution (6500 lb on front axle, 3500 lb on rear), will make possible more king pin load than the conventional tractor. In fact, it often amounts to approximately 3000 lb within legal axle limitations.

The rear axle of the tractor is always the critical axle in terms of legal weight limitations. The tandem dual axle tractor increases the allowable GVW but it is not the best solution for states having total allowable GVW of 58-60,000 lb. The tandem axle tractor with tandem axle trailer having fifth wheel located at up to 15 in. ahead of center line of the tandem would have a gross capacity of 72,000 lb. This is far in excess of the weight allowable, and the higher investment and heavier weight do not indicate that this equipment solves the problem. The fact that a tandem axle cannot give interchangeability with all trailers represents a very serious disadvantage for this type of equipment.

The possibility of greater king pin loading through unique chassis design is shown by a study of a new development by White. In this design an axle with individual wheels mounted directly to the frame is placed ahead of the driving axle, and these wheels steer in coordination with the front axle. [See the Oct. 15 issue of AUTOMOTIVE INDUSTRIES, page 32.]

With this tractor combined with a dual tire trailer, the allowable axle loading is 64,000 lb. This is approximately 4000 to 6000 lb in excess of the maximum allowable GVW in many states, but its light weight and lower investment requirements make it a practical unit where the two axle tractor cannot reach maximum allowable GVW. In addition, the operator can use the excess for tolerance on each axle. In other words, the tractor rear axles and the trailer rear axles are so located that to attain maximum allowable GVW they need only be loaded to 24,000 lb tractor rear axle and 29,000 lb trailer axle. This leaves a tolerance of 3000 lb for each axle under the legal limit.

TABLE IA

Weight Reduction Possibilities For Highway Trucks and Tractors

	Weight for Steel Construction, lb	Weight for Aluminum Construction, lb	Weight Saved, lb
Cab:			
Roof, door, hood, dash panels	868	429	439
Cab frame			
Floor boards			
Tool, battery, seat boxes			
Misc. reinforcements, brackets, etc.			
Chassis:			
Frame rails	1050	630	420
Frame cross members and gussets	519	233	286
Bumper	60	33	27
Fuel tanks and brackets	195	105	90
Air reservoir tank	27	9	18
Tandem rear axle	1320	680	640
Housings			
Differential carrier castings			
Brake spiders and shoes			
Hubs			
Accessory brackets			
Spring hangers, rear frame brackets	150	80	70
Spring hangers, front	60	30	30
Disk wheels, 22 in. (10)	1150	750	400
Sub-Total for Chassis	4531	2250	1981
Engine and Accessories:			
Engine (672 cu in. Diesel 165 hp)	1150	515	635
Cylinder block and crankcase			
Cylinder heads			
Oil pan			
Flywheel housing			
Gear case cover			
Main transmission case and cover	200	90	110
Auxiliary transmission case and cover	150	70	80
Clutch housing	50	25	25
Sub-Total for Engine and Accessories	1550	700	850
Grand Total	6949	3679	3270

So the importance of chassis design in terms of weight distribution to enable truck users to carry more payload must be apparent. In fact, the design factor offers greater opportunity for payload increase than the weight saving by substitution of light metal. It is by a combination of the two that the maximum result will be obtained.

Lighter Trucks for Heavy Hauling

By C. L. Burton and E. P. White
Aluminum Co. of America

As much as 3000 lb might be saved in truck and tractor weight by using aluminum and magnesium alloys. Table IA on the preceding page, using data obtained from several years' work with manufacturers, shows that the tonnages involved are considerable.

Experimental Bench Testing Techniques for Truck and Bus Components

By Gil F. Roddewig
GMC Truck and Coach Div., General Motors Corp.

The advantages of bench testing have been recognized for a good many years. Such testing provides a means for evaluating changes or improvements in many units quickly, cheaply, quite accurately and without delay from weather conditions. At our plant we test a great variety of truck and bus components. Test requests from engineering cover a range from gages, switches, hoses, and fittings to axles, clutches, fuel tanks, frames, and springs and they require from a few days to several months to complete.

Because of the great variety of tests we are asked to make, we must have quite a number of services available, and various arrangements are required. Four of these setups are described and illustrated here.

In Fig. 1 we have an arrangement for checking 18 electric motor driven water pumps used in some of our coach heating systems. From this setup data were obtained on pump seals, motor bearings and brushes, current consumption and water pump capacity. A valve in the discharge line controlled the pressure so that all units were operating under same load. Pressure of any individual pump could be checked at any time by opening a valve connected to pump discharge and leading to gage manifold. Discharge volume, pump speed, and current consumption can be checked. Any pump can be removed from test by shutting off the intake and discharge valves and then disconnecting a flange fitting. This is a good example of how quite a number of units can be tested in a relatively small space.

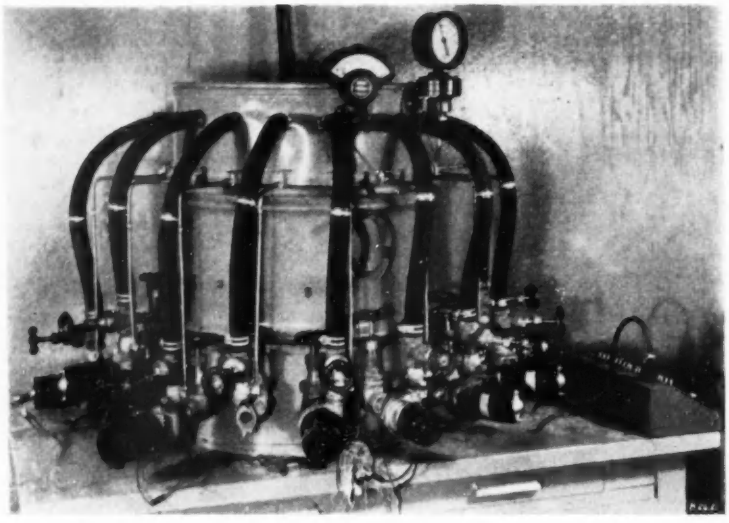


Fig. 1—Arrangement for testing 13 electric motor driven water pumps.

The setup in Fig. 2 has been found very satisfactory for testing fuel tanks. The rocking and bumping of the cradle creates the same effect on mounting straps, tank ends, and internal baffles as does many thousand miles of actual service. The air cylinder which actuates the cradle can be used for many purposes. The length of the stroke can be varied by changing the timing of the valves, and of course the rate of the piston rod can be controlled by the size of the orifice through which air enters and leaves the cylinder.

The adaption of an old principle of vibration to the testing of certain truck components is illustrated in Fig. 3. The vibrating machine consists of an electric motor driving a speed changer which in turn drives the large pulley and shaft at the right. A flexible drive shaft connects the pulley shaft with the driving shaft and gear of the vibrator which, of course, drives the same size driven

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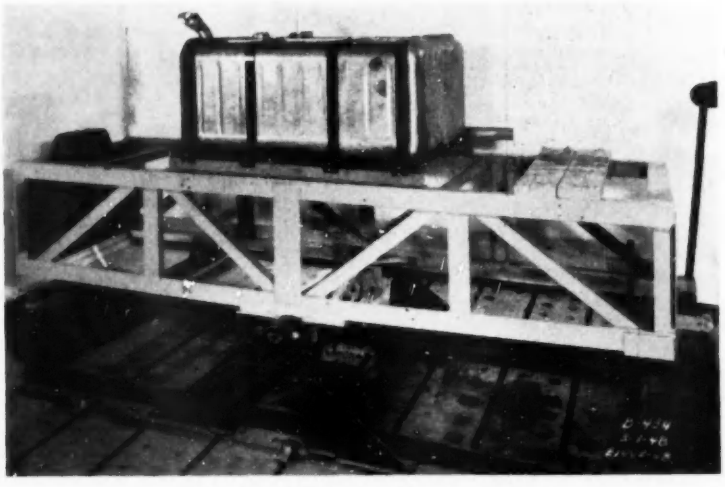
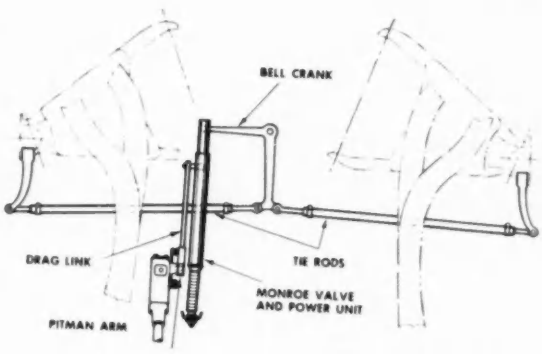
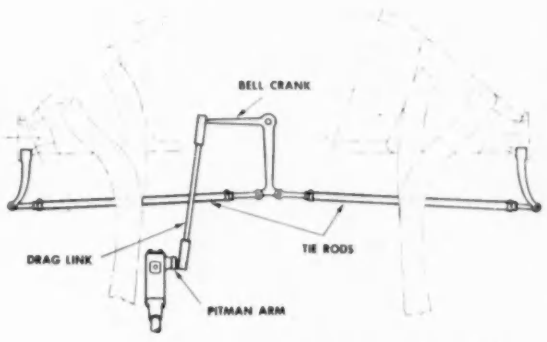


Fig. 2—Air-actuated cradle for testing fuel tanks, etc.

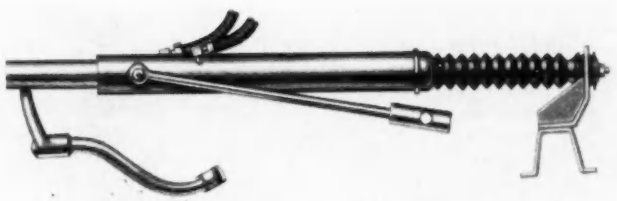


Suggested application of Monroe power steering mechanism in linkage of typical passenger car center-point steering system.



Conventional center-point steering system layout before application of power steering.

Monroe Power Steering in Production



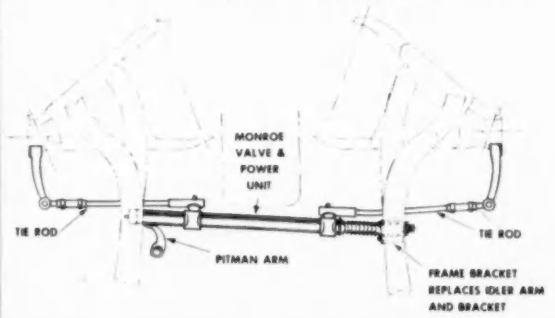
Close-up of Monroe power steering mechanism. The hydraulic power cylinder and valve mechanism are contained in this unit.

ACCORDING to a recent report from Monroe Auto Equipment Co., Monroe, Mich., the company has started production of power steering equipment and expects to have units available for delivery this month.

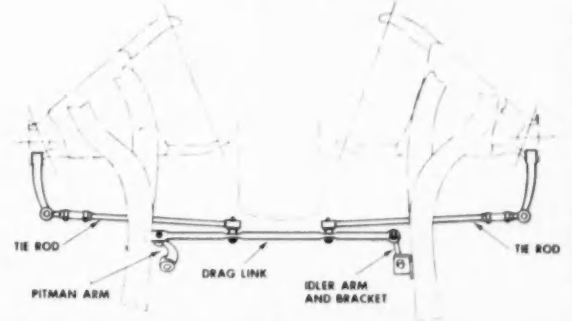
Monroe power steering is of the hydraulic type, incorporating a direct-acting, hydraulic booster mechanism which is installed as a component part of the steering linkage system. It is operated by a conventional type hydraulic pump driven by the engine. The operating valve and power cylinder are contained in a single, compact assembly so as to reduce the amount of plumbing ordinarily required for an installation of this character. The hydraulic cylinder and valve assembly will usually replace the actuating link or drag link in the conventional steering system and, consequently, results in a relatively simple and economical arrangement, according to Monroe engineers.

It may be applied as part of a center-point steering system or a relay steering system on passenger cars, trucks and tractors. The unit, said to be accepted by one passenger car manufacturer, is being tested by others.

Suggested installation of Monroe hydraulic power steering mechanism in steering linkage of typical relay type steering gear layout.



Typical relay type steering linkage layout before application of power steering.



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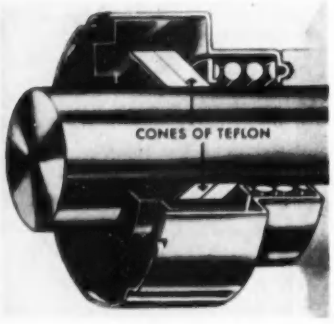


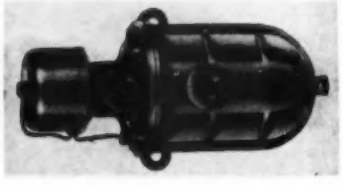
All-Purpose Shaft Seal for Long Service Life

Recently announced is an all-purpose mechanical seal known as the "John Crane" Type 19. It is said to provide life-time performance in small pumps, hot water circulators, and many other rotary shaft applications.

Special beveled cones made of Teflon (DuPont trademark for tetrafluoroethylene resin) are utilized as the flexible member. This adapts the seal for services using water, oil, and corrosives; temperatures from —100 F to 450 F; vacuums and pressures to 200 psi; and high shaft speeds.

Since it is a packaged type unit, the seal reportedly provides quick and easy installation for production assembly and replacement service. It is presently available in sizes to fit shaft diameters of ¼, ⅜, ½, ⅝ and ¾ in. The metallurgy of the seal, bronze, stainless steel, etc., can be specified. *Crane Packing Co.*

Circle P-4 on page 49 for more data



LPG Fuel Unit for Commercial Vehicles

Recently developed is a strainer and Fuelock unit for trucks, buses, and tractors burning LPG. The Fuelock fits on top of the strainer and is operated by a magnet. When the ignition is turned off, the gas line is automatically locked shut.

By keeping out scale and other foreign matter the strainer keeps Fuelock and converter valves from leaking. *Century Gas Equipment Co.*

Circle P-5 on page 49 for more data

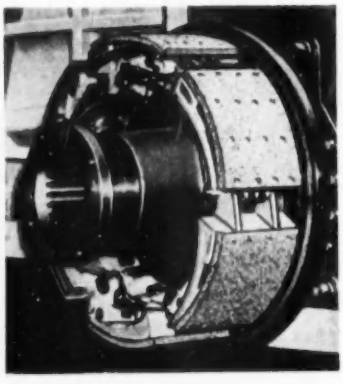
Strapping Unit for Industrial Use

Now available is a strapping unit, said to weigh only 10 lb, 10 oz, that fastens around the waist by means of a belt that is made to hold securely.

Known as The Beltbinder, it is designed to carry tools, strapping, and seals up ladders, scaffolds, towers, etc., in industrial plants.

The unit includes three containers suspended from a belt. One holds a 200-ft coil of strapping which can be cut by a hammer-cutter held in a leather pocket. A canvas pouch with a strapping tool and a supply of seals completes the unit. Strapping and matching seals are made in various widths and metals. *A. J. Gerrard & Co.*

Circle P-6 on page 49 for more data



Combination Air and Hydraulic Brake

Recently introduced is a brake which is said to feature air operation as a service brake with an auxiliary or emergency hydraulic system available in case of failure of the air system. The air and hydraulic systems of the Hydro-air brake are separate and may be applied either independently or simultaneously.

Brake applications designed and developed by the manufacturer run from the smallest general automotive size in a three brake shoe construction (using a nine-in. drum) for hydraulic over hydraulic, to a six brake shoe construction (using a 35-in. drum) for a combination air and hydraulic system.

The dual system brake installed on both tractor and trailer is said to provide a separate and independent "Service" and "Emergency" brake on each and all wheels of the tractor-trailer combination. Each system—service or emergency—is controlled

(*Turn to page 70, please*)

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Materials Handling

Vol. 11, No. 1 of "Handling Materials" describes how the manufacturer's fork lift trucks and tractors can bring improvements and cut costs in materials handling. *Towmotor Corp.*

Circle L-1 on postcard for free copy

Metal Finishing

Now available is Vol. 1, No. 1 of "Finishing Engineer," a new quarterly publication on metal finishing operations. This first issue contains a feature article on Automation at the Ford Cleveland Plant. *Metalwash Machinery Corp.*

Circle L-2 on postcard for free copy

Aircraft Facilities

Recently published is a brochure aimed at acquainting the aircraft industry with the manufacturer's research, development, and production facilities. *Aircraft Div., Rheem Manufacturing Co.*

Circle L-3 on postcard for free copy

Blast Machine

Bulletin No. 223 on the Blastmaster Rotoblast is now available. Eight features that make the machine useful to the foundry and metal finishing fields are illustrated. *Pangborn Corp.*

Circle L-4 on postcard for free copy

Transformer Laminations

Now available is the fifth edition of a transformer lamination catalog (No. EM 3). Included are technical information and full-size drawings of all available standard shapes. Copies should be requested on company letterheads. *Advertising Dept., Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa.*

Engine Pressure Indicator

Bulletin No. EP4 5M describes an engine pressure indicator for measuring pressure-time curves of either gasoline or Diesel engines. The complete system consists of a catenary diaphragm pressure pickup, a strain gage amplifier, and a standard cathode ray oscilloscope. *Control Engineering Corp.*

Circle L-5 on postcard for free copy

Carbide Tools

Vol. 43, No. 12 of "Grits and Grinds" is a special issue devoted to the related subjects of carbide tool grinding and diamond wheel conservation. *Norton Co.*

Circle L-6 on postcard for free copy

Torque Equipment

Recently released is a booklet covering torque testing equipment and torque tools. *Richmont, Inc.*

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(Please turn page)

THIS POSTCARD VOID AFTER MAY 1, 1953

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L-1	L-7	L-13	L-19	E-1	E-7	E-13	E-19	P-1	P-7	P-13	P-19	P-25
L-2	L-8	L-14	L-20	E-2	E-8	E-14	E-20	P-2	P-8	P-14	P-20	P-26
L-3	L-9	L-15	L-21	E-3	E-9	E-15	E-21	P-3	P-9	P-15	P-21	P-27
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L-5	L-11	L-17	L-23	E-5	E-11	E-17	E-23	P-5	P-11	P-17	P-23	P-29
L-6	L-12	L-18	L-24	E-6	E-12	E-18	E-24	P-6	P-12	P-18	P-24	P-30

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Instrument Transformers

The 1953 edition of an instrument transformer guide is now available. The illustrated, 102-page booklet (No. GEA-4626F) contains ratings, ASA accuracy classifications, and prices of indoor and outdoor potential and current units. *General Electric Co.*

Circle L-8 on postcard for free copy

Thread and Form Grinder

Catalog No. 133-52 describes Model 133 thread and form grinder for small precise threads and intricate forms. *The Sheffield Corp.*

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Industrial Facilities

Now available is a booklet describing the manufacturer's extensive facilities for research and precision production. *Lycoming-Spencer Div., Avco Manufacturing Corp.*

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Truck Axles

Recently announced is a booklet (Form No. A-224) on the operation and maintenance of Model 36M tandem drive axles for trucks. *Axle Div., Eaton Manufacturing Co.*

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Nails, Rivets, Screws

Catalog No. 60 covers a line of special nails, rivets, and screws produced by the cold heading method. A number of useful specification tables are included. *John Hassall, Inc.*

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USE THIS POSTCARD

Steel Heat Treating

Recently released is a wire-bound booklet on the Homocarb method with Microcarb control for steel heat treating. *Leeds & Northrup Co.*

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Aluminum Extrusions

Now available is a 98-page catalog on over 4000 standard extruded aluminum shapes, rod, bar, and tubing. Isometric drawings accompany the numerical data. *Precision Extrusions.*

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Power Steering

Just released is a leaflet on a new hydraulic power steering system for automobile, truck, and tractor applications. *Monroe Auto Equipment Co.*

Circle L-15 on postcard for free copy

Strainer Design Manual

Recently released is an engineer's manual of wire cloth strainer design. Various types available are described and pictured. *Michigan Wire Cloth Co.*

Circle L-16 on postcard for free copy

Transfer Machines

Bulletin No. 3000, fresh off the press, describes a series of automatic transfer machines. *The Motch & Merryweather Machinery Co.*

Circle L-17 on postcard for free copy

Industrial Filters

Now available is a four-page bulletin on Delpark industrial filters and quenching oil applications. *Industrial Filtration Co.*

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Cutting Oils

Four Sunicut cutting oils to keep parts and tools up to 50 deg cooler are described in technical Bulletins Nos. 12 and 13. *Sun Oil Co.*

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Aircraft Equipment

Recently released is a brochure on screw assemblies, worm gears, and fractional horsepower motors for the aircraft and allied industries. Each unit and its components are said to be designed to specification for the function it is to perform. *Vard, Inc.*

Circle L-20 on postcard for free copy

Bulldozers

Ready for distribution is a 36-page catalog on a line of bulldozers and their attachments. Each model is fully described and illustrated. *Caterpillar Tractor Co.*

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(*See preceding page*)

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L-6	L-12	L-18	L-24	E-6	E-12	E-18	E-24	P-6	P-12	P-18	P-24	P-30

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NEW AIRCRAFT PRODUCTS

FOR ADDITIONAL INFORMATION, please use postage-free reply card on PAGE 49

Pressure Monitors

Recently developed is a line of sensitive pressure monitors. These units are said to provide precision and accuracy in the flight programming of aircraft and guided missiles.

Basically, the pressure monitor consists of a temperature compensated diaphragm mechanism and an inductive pickoff. Depending on the type of diaphragm used, it reportedly provides various types of data such as altitude, air speed, vertical speed, and differential and absolute pressure. The inductive pickoff electrically signals the approach to a preset pressure and variations from that point. *Kollsman Instrument Corp.*

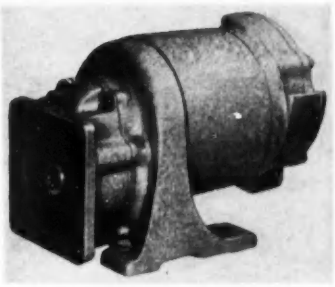
Circle P-1 on page 49 for more data

Three-Phase Geared Motor

Now in production is a two-hp, 400-c, three-phase, a-c aircraft motor. Known as Type GA, this unit is said to offer internal gearing to provide multiplied torque at low speeds for driving such components as hydraulic pumps, compressors, hoists, etc.

A wide range of gear ratios with output speeds from 1500 to 5000 rpm reportedly permits selection of the most efficient speed to drive the component. The motors are designed to meet the requirements of Air Force Spec. No. 32590.

Features of Type GA include hardened and shaved helical gears, pyramidal base, integral fan for self-ventilation, internal spline take-off shaft, and mounting pad. *Aircraft Div., U. S. Electrical Motors Inc.*



U. S. geared motor.

Circle P-2 on page 49 for more data

Gyro Instrument Calibrating Device

Recently developed is a gyro instrument calibrating device for calibrating and evaluating rate gyros and associated equipment.

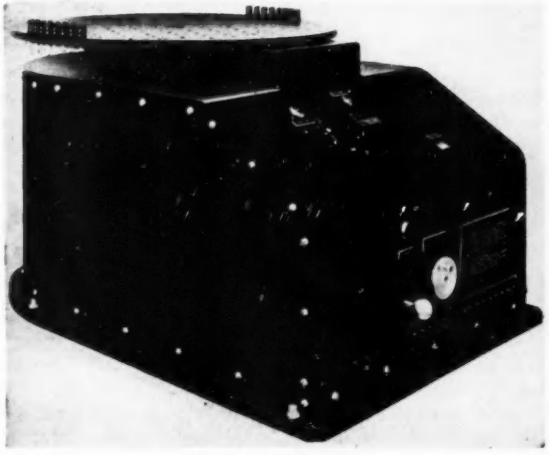
The drive system is said to do away with gearing and backlash. Heart of the unit is a steel-to-steel friction drive whose output to the table is continuously variable from 0.01 deg/sec to 1200 deg/sec by means of a single control which makes 36 turns for full-scale traverse. The drive is powered by a synchronous motor operating from line frequency.

An indicator drum carrying a scale 25 in. in length is coupled directly to the rate-controlling lead screw. Indicated rates have been demonstrated to be accurate and repeatable—upscale or downscale, forward or reverse—to within one per cent of actual rate.

Performance measurements show that the model has successfully minimized vibration and wow conditions. Irregularities in angular velocity at frequencies up to 100 cps reportedly do not produce tangential accelerations, at a radius of 10 in., in excess of ± .005 g. Vertical accelerations at frequencies up to 100 cps do not exceed ± .012 g, it is claimed.

The machine is 18 in. high, 24 in. wide, 36 in. deep, and weighs approximately 275 lb. There are 108 mounting holes in the surface of the table arranged in a regular two-in. equilateral pattern. The holes are tapped to ¼ by 20 threads.

The table is not adaptable to sine-wave oscillation, Scorsby oscillations, loop servo feedback systems or other similar gyro tests. It is free-wheeling, however, when mechanically disengaged to permit certain precession and drift tests in addition to its primary purpose of producing controlled rates-of-turn. *Genisco, Inc.*



Genisco gyro instrument calibrating device.

Circle P-3 on page 49 for more data

News of the MACHINERY INDUSTRIES

By Thomas Mac New

Prospects Bright for More Realistic Tax Amortization Rates on Industrial Equipment. Aluminum Rolling Mill Planned for West Coast.

Rolling Mills

A new type of rolling mill for the fabrication of tapered aluminum alloy plates and sheets—of the type that are necessary for the production of the latest military aircraft—is being designed and built by Hydropress, Inc., New York, N. Y.

According to Hydropress officials, the 145-in. four-high rolling mill will be the largest installation of its kind in the world. It will permit the hot or cold rolling of aluminum alloy sheets and plates from 0.032 in. to 3.0 in. thickness. Operation is scheduled for late 1953.

On the West Coast plans are underway for the construction of the first rolling mill in that area for the production of aluminum sheets, strips and circular shapes. This was announced by the Harvey Machine Co., Inc., Torrance, Calif. Erection of a new plant which will cost approximately $20 million will begin as soon as a suitable site is selected. The new mill will include heat treating equipment for the production of high-strength aluminum which is needed by the aircraft industry.

Cold Reduction of 18 In. Tubing

Graham B. Brown, Tube Reducing Corp., recently presented a paper before the American Ordnance Association on "A Machine to Cold Reduce 18-In. Tubing." In this paper it was pointed out that such a machine is under construction at the E. W. Bliss Co., Canton, Ohio.

The machine is being made up of a series of sections, each more or less independent of the other, and the total to be about 100 ft long. To drive the machine, a pair of 13 in. hydraulic cylinders operating under a working pressure of 2200 psi are to be utilized. The oil required is 5400 gpm, and each cylinder will be driven by its own pump. The pumps have been especially designed for the project by the Waterbury Tool Co.

The saddle of the unit resembles a 50 in. mill roll housing equipped with four 36-in. wheels which suspend it from rails seven in. above the pass line. Completely assembled with rolls, roll neck bearings, etc., the saddle has a gross weight of 150 tons. Maximum travel of the saddle is about 73 in., the length being that required to rotate the rolls slightly less than 180 deg.

Both Tube Reducing Corp. and E. W. Bliss Co. took part in the ultimate design of the unit.

Short Term Amortization

From our Washington Bureau we learn that bright prospects for easing the current tax amortization rates on machine tools and many types of industrial machinery are on the horizon. Chances for an early improvement in the present rates are extremely good.

Previous political administrations took the position that the Government could not afford to run the risk of losing revenue under a revised amortization schedule. They refused to concede the industry point that more—not less—revenue would probably result over the long pull from short-term amortization.

The picture is basically different under President Eisenhower. Treasury Dept. officials have placed the depreciation problem at the very top of their list of tax conditions that need remedying. Engineers are working side-by-side with revenue experts at the Treasury, in efforts to come up with an early and workable solution. One high Treasury official points out, "We are definitely thinking that some machines should be amortized in 10 years, some in 12, and possibly some in 15 years, instead of the general 20 year rule that now applies."

It is important to keep in mind that the forthcoming new rates will apply only to machinery and equipment bought after any new rates become effective. At present, there is no intention of making any of the new rates retroactive to apply to machinery purchased prior to the effective date of the rule changes.

The problem won't come before Congress for at least several more weeks. The Treasury's recommendations will no doubt carry a great deal of weight, but such specific points as the effective date for the new rates may be threshed out in congressional committee sessions.

All-Time High for Bullard

In the Annual Report just released by The Bullard Co., it is pointed out that 1952 sales increased 74 per cent over 1951 and that the $57 million volume amounted to an all-time high in the history of the company. Approximately 75 per cent of Bullard's sales for 1952 is subject to renegotiation. According to E. C. Bullard, president and general manager, the current backlog of unfilled orders amounts to $55 million after cancellations. Federal taxes and renegotiation took a little over 23 per cent of the firm's total income during 1952.

Atomic Energy

A report on Industrial participation in atomic energy development has been prepared by the Council for Technological Advancement, Chicago, Ill. In discussing the potential role of private industry in atomic energy development, the report calls attention to the need for a program which will encourage in atomic energy the same kind of competitive effort which has made the automobile industry what it is today. Under present conditions, only a few companies share in and contribute to advances made in this area. Maximum benefits will be attained only when private enterprise is able to participate in this technological advancement to the same extent that it has in those of the past, according to the report.

NEW EQUIPMENT PLANT • PRODUCTION

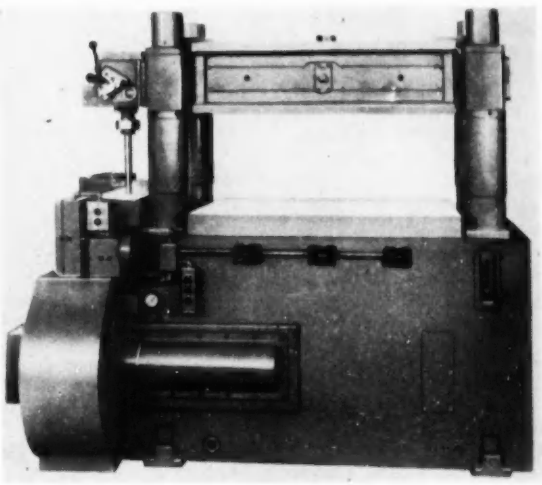
FOR ADDITIONAL INFORMATION, please use postage-free reply card on PAGE 49

Rotating Head 100 Ton Die Tryout Press

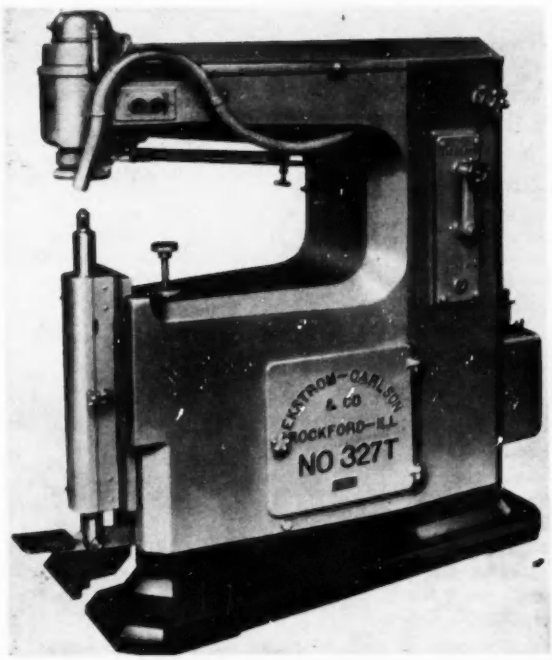
Now ready for the trade is a 100-ton die tryout press in which the head can be quickly released and rotated to any point up to 240 deg.

Four post construction is claimed to assure perfect alignment of both punch and die. The air clutch is a combination flywheel type, air operated, with multiple disk brake. Electrical controls permit inching, single stroke, continuous operation and forward or reverse operation. Two, hand safety push button contols and one emergency stop button are standard equipment. The press has a six in. stroke and operates efficiently at 50 strokes per min. Lubrication to all working parts is by forced feed. *Alpha Tool Works.*

Circle E-1 on page 49 for more data



Alpha 100 ton die tryout press.



Ekstrom, Carlson trim router, Model 327-T.

Trim Router for Non-Ferrous Parts

Designed especially for the aircraft industry, the No. 327-T trim router is suited for trim routing large nonferrous sections. Either of two spindle speeds, 10,000 and 20,000 rpm is obtained with a selector lever and a belt change, and three, five, or 7½ hp spindle drive motors at 3600 rpm are optional.

Physical dimensions of this machine includes a 27¾ in. throat clearance and a floor to guide pin holder height of 32¾ in. The adjustable distance from the end of the guide pin holder to the face of the spindle ranges from a three in. minimum to a maximum 9¼ in. Spring-loaded, sliding guide pin holder provides a 6¼ in. maximum stroke, controlled by means of an adjustable, screw-type stop. *Ekstrom, Carlson & Co.*

Circle E-2 on page 49 for more data

(Turn to page 54, please)

NEW EQUIPMENT PLANT • PRODUCTION

For additional information, please use postage-free reply card on page 49

(Continued from page 53)

lathes utilize hydraulic pre-selection of speeds which can be made while the table is rotating. There are 16 spindle speeds in a ratio of one to 50. Maximum table speed is 310 rpm for KE 100 models.

Direction of feed and rapid traverse are actuated by spring-loaded monolever controls; one for normal feeds, another for rapid traverse. Each lever permits normal directions of feed or rapid traverse plus angular compound. *Kurt Orban Co., Inc.*

Circle E-3 on page 49 for more data

Vertical Column Turret Lathe

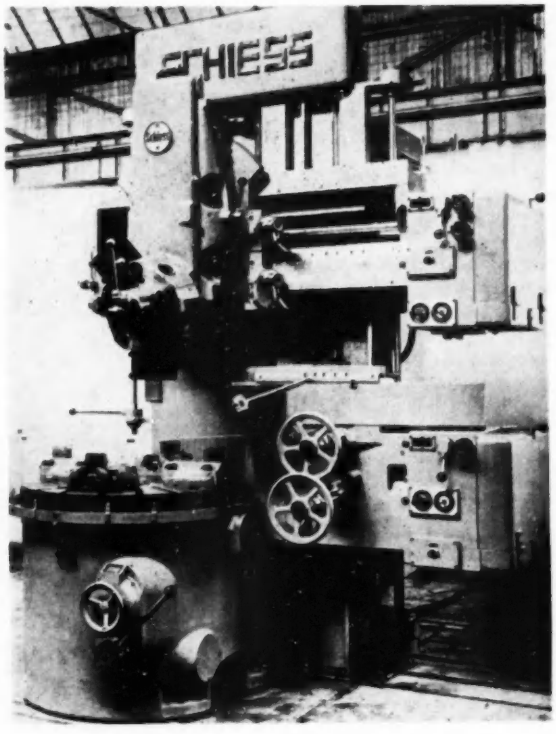
Newly designed Schiess single column vertical turret lathes primarily intended for high-speed machining with carbide tools are now being distributed in this country.

Available in 39 in., 49 in. and 65 in. turning lengths, the KE series has an all-vertical gear drive with the main motor mounted in a vertical position on the back of the machine and directly connected to the gear box through a vibration-absorbing coupling. The gear box is also vertically mounted so that changes in the direction of the drive are transmitted to the table without bevel gears.

Separate column and table base construction is claimed to permit fine adjustment and close table tolerances against the column ways for both the cross rail and the vertical ram. Table runs on tapered roller bearings.

Vertical ram, cross rail and side head are all counterbalanced. A single lever unlocks, raises or lowers, and locks cross rail simultaneously by electro-mechanical controls.

These single column vertical turret



Orban distributed Schiess turret lathe.

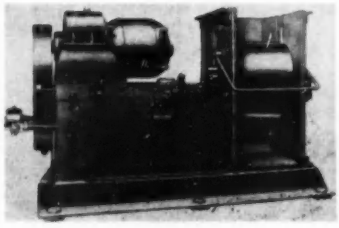
Scrap Bundling Machine for Wire and Strip

Specifically designed for handling scrap of a stringy nature, a scrap bundling machine has been introduced which forms scrap into compact cylinders. It is recommended by the maker for bundling steel, aluminum, brass and lead—either in wire or strip form. It is available in two models: Model 18, which forms a roll 18 in. in diameter and 18 in. in length; and Model 24, which produces a roll 24 in. in diameter and 24 in. in length.

In operation, this machine forms scrap into cylinders around a revolving spindle. Power is transmitted to the spindle through a sprocket and multiple strand roller chain drive system. Design of the spindle includes a keyway connection with its drive sprocket, allowing it to be removed mechanically to discharge bundled scrap. To discharge scrap an air pressure system is employed. First the spindle is withdrawn, then a pusher ram rolls the scrap bundle out of the hopper. Spindle and ram also are returned to their bundling positions by the air pressure system.

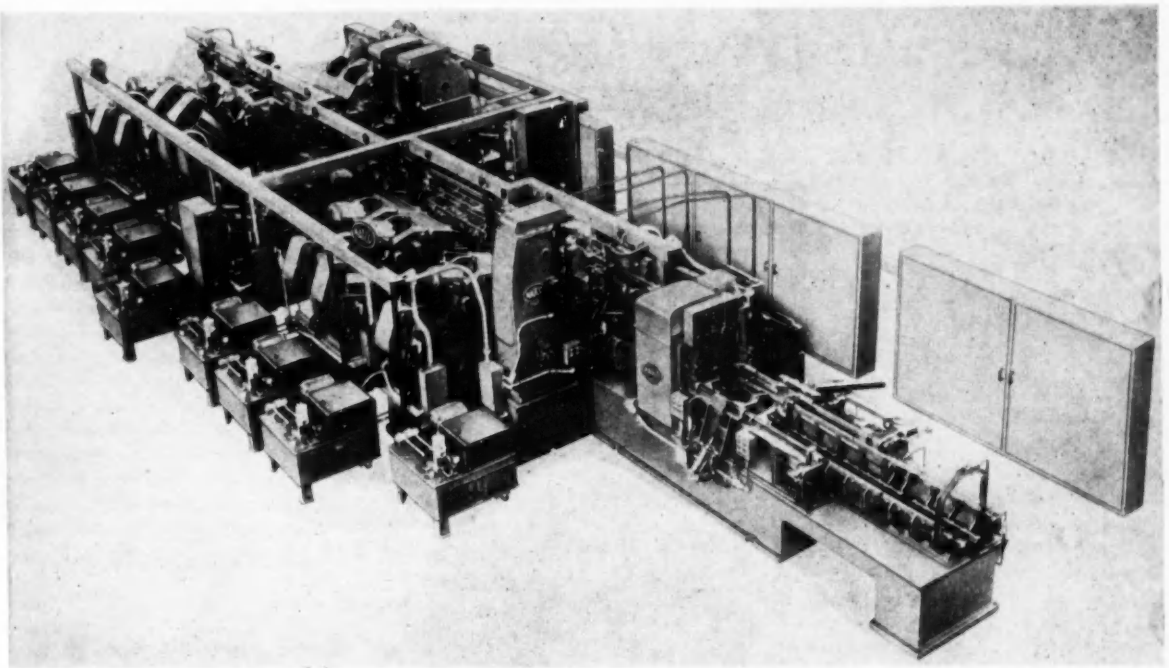
A 10 hp gear motor is supplied with Model 18, a 15 hp motor with Model 24. Operating speed of the bundling spindle is 45 rpm. A safety switch lever extends across the front of the hopper. An additional safety feature is the start-stop-reverse switch, which can be adjusted so the operator must hold the button down while the machine is in operation. *McLanahan and Stone Corp.*

Circle E-4 on page 49 for more data



McLanahan and Stone scrap bundler.

Automatic Transfer Machine for Engine Blocks

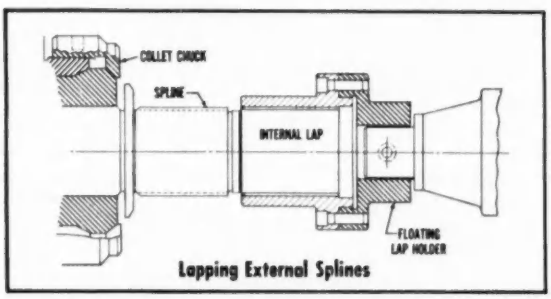


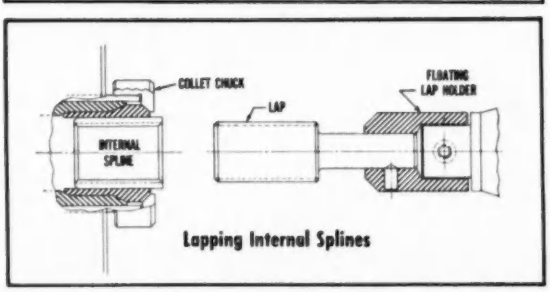
Completion of this large Natco Haleway machine which is capable of completing 55 operations on engine blocks at the rate of nearly two parts per minute has been announced. Operations include milling, drilling, combination core drilling and chamfering, reaming, combination spot facing and chamfering, combination rough counterboring and spot facing, rotating part 180° and vibrating for chip removal and also inspecting holes. The machine has 19 stations and requires one operator. (National Automatic Tool Co.)

Circle E-5 on page 49 for more data

Lapping Method Developed for Internal and External Splines

A method for lapping small internal splines and non-rolling external splines and gear forms has been developed. The method, which can be applied to either the Michigan Model 996 or Model 998 internal gear lappers, permits production lapping of external splines that are of insufficient depth to allow continuous rolling contact with a lap in external lapping machines, as well as production lapping of internal splines so small that it is impractical to make a lap that will roll with the spline.





Michigan lapping method.

For lapping the external splines, parts are chucked in an internal lapping machine. An internal toothed lap having the same number of teeth as the spline is mounted in a floating holder on the reciprocating lap spindle. The lap is made with sufficient clearance to slide over the spline.

In operation, the work drives the lap and the lap spindle reciprocates on the work centerline while the work and lap rotate together. The lap spindle is braked hydraulically to give lapping action to one side of the splines. Work is rotated in the opposite direction to lap the opposite side of the splines.

For lapping internal splines, a similar arrangement is used with the internal splined member in the chuck and the external splined member mounted on the lap spindle with a floating holder. Splines as small as one-in. pitch diameter can be lapped by this method. *Michigan Tool Co.*

Circle E-6 on page 49 for more data

(*Turn to page 56, please*)

NEW EQUIPMENT PLANT • PRODUCTION

For additional information, please use postage-free reply card on page 49

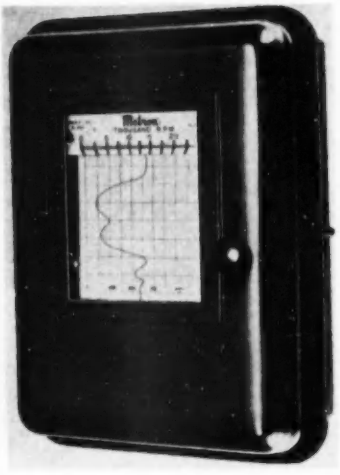
(*Continued from page* 55)

Speed Recorders

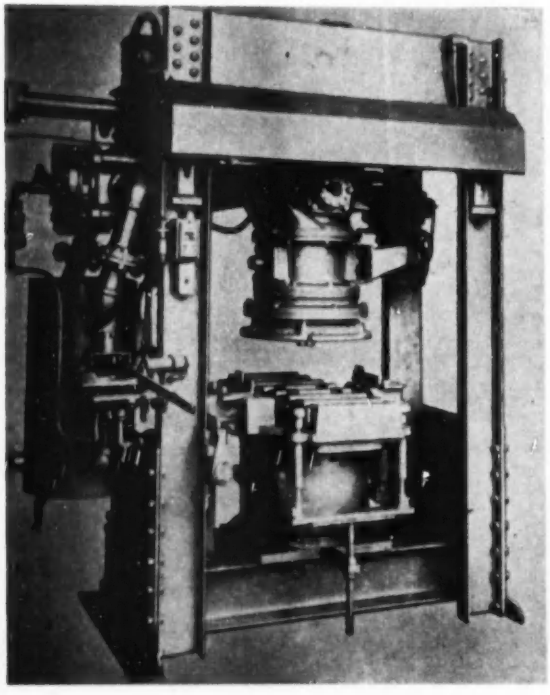
Series 81M strip chart speed recorders, which are General Electric Type CF-5 instruments modified for use with Metron tachometer indicators and heads to record speed, have been placed on the market. Eighteen different speed ranges are available from zero to 50 to zero to 100,000 rpm, fpm, cpm, yd per hr, ipm or virtually any other speed unit.

Charts are four in. wide, 65 ft long, and have 50 or 60 minor divisions depending upon the speed range selected. Sustained accuracy is said to assure dependable records even when the recorder is as much as 1000 ft from the engaged speed. Duty is continuous-up to 30 days on a single roll. *Metron Instrument Co.*

Circle E-7 on page 49 for more data



Metron speed recorder.



Demmler core blower, Model 103.

Molding Compound

Recently announced is a high-impact, glass-fibre-filled, one-step phenolic molding compound. Known as 16221 Natural, it was formulated for applications where high shock resistance is required. Excellent dimensional stability and a high modulus of elasticity are claimed for the product.

The material is said to be readily molded by standard compression methods. Pressures of 5000 to 6000 psi are recommended, but high-frequency preheating permits the use of lower molding pressures. Cure time is reportedly only slightly slower than for general-purpose materials. *Durez Plastics & Chemicals, Inc.*

Circle E-8 on page 49 for more data

Core Blowing Machine

According to the maker, an extremely fast core blower, originally designed especially for the high speed production on one of the new defense projects, has just been released for sale to the foundry industry in general. It will be called the Demmler 103.

The machine will blow and draw eight cores in a box with a 5½ sec machine cycle. It has a fully automatic cycle control which is accomplished by the use of a hydraulically controlled air timer. This timer permits the operator to operate an adjacent roll-over while the machine is going through its blowing cycle and the core blowing cycle can be infinitely controlled by the turning of a control knob. Hard chrome-plated valve seats protect the timer from corrosive foreign matter in the foundry air lines which might impair its efficiency and accuracy.

A stationary magazine on the new core blower is said to assure perfect alignment of the core box at all times and core box handling devices may be installed without difficulty. The core blower has a large throat opening to permit the smooth flow of sand from supply hopper into the throat of the machine.

The Demmler 103 is built with compact but sturdy structural steel construction and all parts have been made easily accessible for quick maintenance. *Wm. Demmler & Brothers.*

Circle E-9 on page 49 for more data

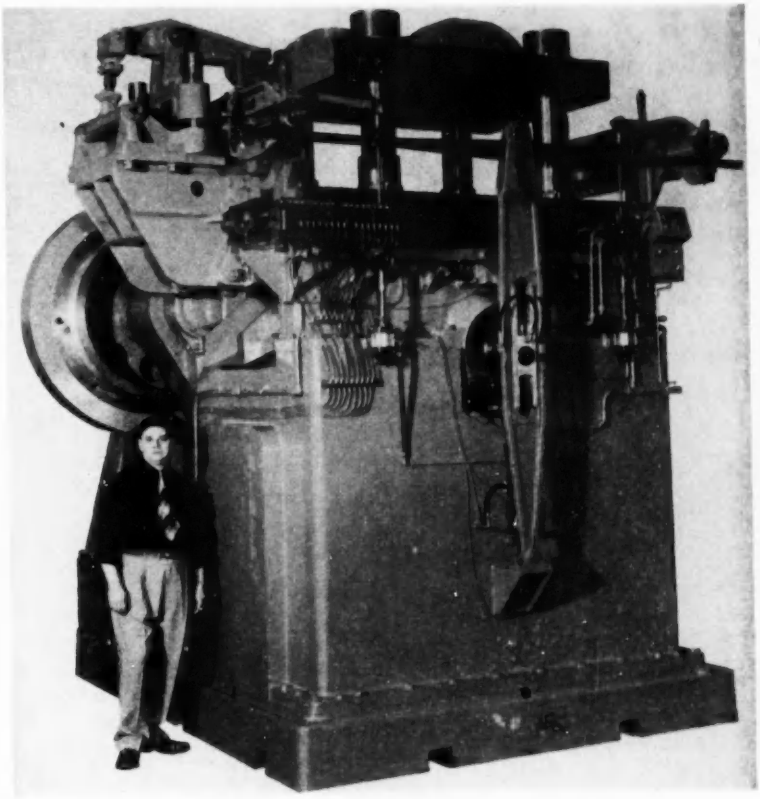
High-Speed Automatic Dieing Machine

Handling metal up to 25 in. wide and 11/32 in. thick, a high-speed automatic dieing machine makes completely drawn and formed stampings in 13 operations by the progressive die method.

In one of its first applications the automatic machine makes right and left hand parts for an automotive window control gear at the rate of 60 complete pairs per minute. Steps performed with each stroke of the machine include notch, pierce for pilots, draw, bend ears, and nine other operations. Material used is 0.065 in. thick hot rolled steel in coil form. Up to 16 in. strokes can be provided for producing straight shells up to 3⅜ in. long and tapered or hemispherical shells of greater lengths.

Precision alignment of the tools is said to be provided by the unique construction employed. In the dieing machine any angular thrust from the crankshaft and connection is absorbed by the lower crosshead. *Henry & Wright Div., Emhart Mfg. Co.*

Circle E-10 on page 49 for more data



Henry & Wright dieing machine.

12,000 Lb. Towing Tractor for Heavy Industry

A towing tractor, the Clarktor-120, has been designed to meet the requirements of aircraft manufacturers and heavy industry. The Clarktor-120 has a drawbar pull rating of 12,000 lb and is powered by a 16A Chrysler engine. Fluid coupling, exclusive Clark axle design and low silhouette are features of the new tractor.

The six-cyl Chrysler gasoline engine develops 114 bhp at 3200 rpm. Its displacement is 265 cu in., and it provides 215 ft lb maximum torque. The fluid coupling is used in conjunction with a dry plate clutch.

Clarktor-120 has four speeds forward, with a maximum of 16.3 mph, and one reverse—2.17 mph. The special heavy-duty four-speed transmission is of Clark's own manufacture. Helical gears and mainshaft are made of carburized alloy steel, forged and heat treated to obtain maximum properties of the steel for clash, wear, distortion and strength. The shift lever is tower-mounted on the transmission.

The rear axle embodies double reduction gearing with the final reduction of the planetary type mounted in the wheels. In this construction the drive shaft extends through the tube that supports the wheel bearings and transmits the torque to a set of three planetary gears and in turn each transmits its portion of the load to the wheel. The reaction from these gears is transmitted to a ring gear which in turn is splined to the housing. First reduction is at the differential and employs the latest type of hypoid construction. Drive shafts are of heat treated alloy steel.

Front axle is a pivot mounted type of special construction which is claimed to contribute to the maneuverability and results in a machine that can be turned within a 127 in. radius.

Twin gas tanks, each with its own gage, have a total capacity of 25 gal and enable the Clarktor-120 to operate eight to 10 hr without refueling. Truck-type hydraulic brakes, with 280 sq in. braking area, are standard. An electric horn, headlights and tail light are standard equipment.

A Holland automatic coupler is standard equipment. The coupler mounting is drilled to locate the coupler at standard height, 18¼ in. from floor to eye center. A winch containing 300 ft of ½ in. cable with a No. 5 hook is optional at extra cost. Its drawbar capacity is 10,000 lb. Also available at extra charge is an all-weather cab of all-steel construction, sound deadened and insulated throughout with plastic compound. *Clark Equipment Co.*

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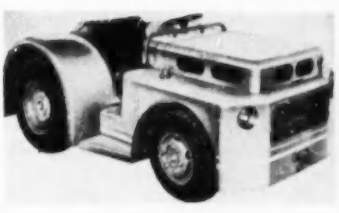


Clark towing tractor.

METALS

Easing of Current Copper Scarcity Foreseen. Aluminum Brings Higher Price. Controls Over Tin Removed by NPA.

By William F. Boericke

Decontrol Expected to Advance Copper Price Sharply

Following the removal of OPS control over copper scrap the price jumped about four cents per lb over the old ceiling level to 25½ cents. This should result in speeding up the flow of scrap to the primary smelters by whom it is badly needed to augment domestic mine output. For nearly two years dealers in scrap have held back supplies awaiting decontrol. Only 46,000 tons of scrap went to the primary smelters in 1952. It should have been over 100,000 tons.

Assuming that decontrol of copper metal follows decontrol of copper scrap, the new price of scrap offers a clue to the future price of domestic refined metal. A four cent increase would bring the price to 28½-29 cents per lb from the OPS ceiling of 24½ cents. This is about in line with most predictions in the trade which have generally forecast a price close to 30 cents per lb for domestic copper with a sharp decline in the foreign price to match this figure.

This may be wishful thinking for the policy of the Chilean government is unpredictable and U. S. copper industry is vitally dependent on imports of Chilean copper. Heretofore Chile has been getting 35½ cents per lb for copper at Chilean ports or 36½ cents delivered in the U. S. American-owned copper mines in that country get 24½ cents with the difference to the Chilean government. It is certain that Chile will not accept a cut of six cents per lb to 29-30 cents with equanimity. The Chilean Congress has recently authorized the government to fix the price for copper bought from the American producers who may be heard from but have no other recourse.

Chile alone is receiving 36½ cents in this country. Other foreign producers take a lower price which has averaged about 34¾ cents. The European price is even lower and demand is weakening. A good tipoff on future trend is reported action of three large Canadian copper producers who accepted 30 cents per lb for delivery to the U. S. stockpile over the next two years. If a higher price than this were in prospect it is hardly likely such a contract would have been signed.

Signs are not lacking that the current copper scarcity will ease. The International Materials Conference announced that, because of improving supplies, international allocations for the metal will be terminated. The January statistics bear out belief that copper inventories are increasing and there may have been considerable overbuying for inventories on the theory that the domestic price would advance sharply when decontrolled and 24½ cent copper would be just a memory. Copper fabricators have been steadily adding to their stocks on hand which stood at 333,455 tons at the end of the year as compared with 254,868 tons last March. Shipments to their customers totalled 117,300 tons in December, during which they took in 143,000 tons from the smelters. They took in 125,000 tons in January. A sudden reversal from a sellers' to a buyers' market such as occurred in lead and zinc in 1952 is something that must be considered possible.

Zinc and Lead Markets Lower

A discouragingly slow demand and further reductions in allegedly unprofitable prices of lead and zinc characterized the first six weeks of 1953. Up to the middle of February the lead price had been reduced three times since the first of the year, falling from 14¾ to 13½ cents per lb. Zinc had suffered even worse with three price cuts that sent the metal to 11½ cents from 13 cents, East St. Louis. At this price zinc sells about 40 per cent below its ceiling that had held up to eight months ago.

Of the two metals, lead appears to be in better position and the outlook is more hopeful. Lead imports in 1952 were very large, estimated in excess of 535,000 tons, more than twice as much as in 1951. But there is hardly any reason to believe that the 54,000 ton rate of last November will be maintained in 1953. The loss of January's production because of a strike at the Port Pirie smelter in Australia will be shortly felt, and closing down of one of St. Joseph Lead Company's smelters will tighten the supply further. On the demand side, battery manufacturers have been buying more freely as Detroit steps up its automobile output, and cable makers are taking more lead as supplies improve.

Demand for Zinc Is Quiet

The outlook for zinc is less favorable. While it is undoubtedly true that a price of 11½ cents per lb is not profitable for most American zinc mines, shutdowns have not yet been sufficiently widespread to cause any large decrease in mine output. The January statistics were somewhat discouraging. Slab production was slightly larger than in December, while stocks of metal in producers' hands were up at the end of the month and unfilled orders fell to 39,700 tons, off 5500 tons from the year's end.

Demand remains slow and the successive price cuts have failed to encourage buyers' confidence in the

(*Turn to page* 82, *please*)

News of the Industry

(*Continued from page* 18)

Pan Am Proposes Air Cargo Rate Cut

Pan American World Airways has proposed to its fellow members of the International Air Transport Association a cut in trans-Atlantic air cargo rates for bulk shipments, which will enable air cargo on a variety of items to underbid surface costs.

The proposal calls for a reduction of 45 per cent in the rate for shipments of over 1100 lb. Bulk shipments would travel for 60 cents per lb for the New York to London service as against the present $1.10.

In Latin America, a PAA spokesman said, in many fields air transport has already won the major share of the total shipments. Outboard motors weighing 3300 lb went by Clipper Cargo from Peterboro, Can., to Caracas, Venezuela, for $926.76, in one week. By surface transportation this shipment would have cost $1,019.16 and would have taken one month.

U. S. Airlines, Inc., air freight carriers, have effected an interline agreement with PAA to supplement the latter's regular cargo service which links Europe, the United States and Latin America, according to announcement made recently by U. S. Airlines president Fred A. Miller.

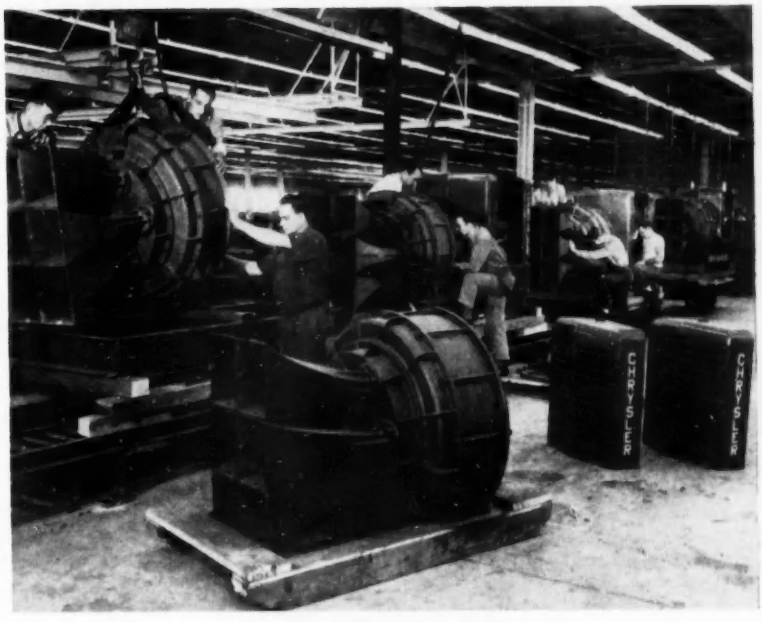
U. S. Airlines operates between New York and Miami with stops at intermediate points. Miller pointed out that the new Pan American-U. S. Airlines agreement will facilitate through air freight service into the entire Central and South American regions for shippers from northeastern cities, especially New York and Philadelphia.

Free Piston Locomotive Attractive in Tests

The free piston gas turbine locomotive produced by Régie Renault of Paris (AUTOMOTIVE INDUSTRIES Oct. 15, 1952) has completed a series of tests by the French State railroad technical department and has now gone into routine service on the Paris to Cambrai line, a round trip of 250 miles, where it hauls a load of 240 tons.

Rail tests on the Paris to Granville line covered first the adjustment of the auxiliary units, then the response of the machine to drive controls. It was found possible to change in a few seconds from no load to full load and a change in direction took less than one second. Various tests were made on the level, on gradients, and with various tonnages on a dynamometer car, the results being slightly better than the estimates.

A test on the round trip Paris to Cambrai, a distance of 250 miles, hauling a load of 240 tons, showed that the generator consumed 341 American gal and the auxiliary Diesel engine 29 gal of fuel. On the basis of the local price of fuel, the cost of the free piston gas turbine, running at half load at a speed higher than 25 mph varied between 3.5 francs and 5 francs per horsepower-hour. This is said to be better than a Diesel locomotive with mechanical transmission and much better than that of an oil-burning steam turbine. Evenutally the auxiliary generator for driving the accessories will be replaced by gas taken from the main generator, thus effecting still greater economy.



FOREWARNING

Air raid sirens come off the assembly line at the Chrysler Corp. Trenton, Mich., plant. Powered by the 180 hp Chrysler V-8 engine, the siren develops 138 db of sound at 100 ft from the throat.

British Air Show on New Film

The world-famous annual air show at Farnborough, England, where the best new British aircraft are put through their paces for the public, has been recorded in a new motion picture produced by Shell Oil Co.

Running 26 minutes, the 16mm sound picture includes spectacular air-to-air shots of fighters breaking through the sonic barrier, of the 140-ton Saunders Roe "Princess" flying boat, and many others. Delta-wing aircraft are shown in aerobatics.

The film is suitable for general audiences of aviation enthusiasts and specialists. "Highlights of Farnborough, 1952" can be borrowed without cost by interested organizations by writing to Public Relations Dept., Shell Oil Co., 50 W. 50th St., N. Y. 20, N. Y. or 100 Bush St., San Francisco 6, Calif.

Underwriters Offer Lower Rates for Safe Drivers

Recognizing that the high cost of automobile insurance is inequitable to safe drivers, several underwriting companies are trying out experimental plans which will result in lower premiums for accident-free drivers. Liberty Mutual Insurance Co. will put such a program into effect in California, Feb. 1.

(*Turn to page* 62, *please*)

Observations

By Joseph Geschelin

Power Race

Fragmentary reports the country over indicate that newspaper editors have taken a rather dim view of the trend to high horsepower ratings in passenger cars. More disturbing are the rumblings in State legislatures where the folks are talking about special legislation to curb road speeds. For example, there is a bill in Lansing, Mich., to enact a state law limiting speed to 65 mph on the highway. Some citizens are talking about putting governors on motor car engines. This sort of thing would be downright dangerous, even if it were remotely practical. Something should be done to explain to the layman that if a governor is designed to limit engine speed, that device will effectively prevent the driver from accelerating in a particular situation and might easily kill him. A governor on passenger cars might be more of a killer than speed or lack of brakes. Let's keep them on heavy duty trucks where they belong. Nevertheless, here is a serious problem. If the trend to greater engine output persists, the situation should be rationalized for the benefit of the man on the street and the layman in government. And it has to be done quickly.

We are indebted to Chrysler Corp. for some sound thinking on the current horsepower race situation, expressed in a recent brochure entitled "Horsepower and P.F." The gist of it is that horsepower ratings do not make performance since horsepower is only one element in car performance. We might expand on Chrysler's statement by noting that horsepower ratings, as published, are not always what they seem. The term horsepower means something very definite to the engineer, but unless ratings are actually comparable in terms of standard definitions and uniform test procedures, they can be quite misleading. Only when advertised ratings specify the conditions of testing and show exactly what equipment is on the engine under test conditions can direct comparisons be safely made. We need not labor the point that the rating of a stripped engine differs from one equipped with fan and full electrical equipment. Depending upon the size of an engine, the accessory load as installed in the vehicle may easily reduce the "stripped" rating by 15 to 20 hp.

Boosts Compression

GMC Truck and Coach has made a remarkable forward step in the design of its new engines for light vehicles for 1953. Through the advanced design of combustion chambers, GMC engineers have found it possible to provide a compression ratio of 8 to 1 and yet operate the vehicles on regular service station fuel. This marks an excellent commentary on the progress in building mechanical octanes into the basic engine structure at a time when engine developments could easily be stifled by the confused fuel picture stemming from an unprecedented military demand.

Visual Action

Our hat is off to Ollie Kelley and his associates at General Motors for the visual demonstration of the cycle of events in the new Buick Twin Turbine Dynaflow which was designed for exhibition at the Motorama. The mechanism was in a plastic housing, using different colors for each element, and employing a colored fluid. Several thousand tiny synthetic rubies were contained in the oil bath, making it possible for the layman to watch the flow under all conditions of operation. At the GM laboratories, a similar set-up, employing ultra-high-speed motion picture photography made it possible to study the behavior of the torque converter and assisted in determining the curvature of blading at various points. As a matter of interest, the GM release on this subject hastened to explain to the public that the rubies are used only as a demonstration aid and are not found in Buick transmissions.

Titanium Progress

At the recent SAE National Meeting in Detroit, C. L. Bradford, Rem-Cru Titanium, Inc., reported that constant progress has made it possible to jump titanium ingot size from pounds to tons, two-ton ingots now being in production. Obviously, whatever titanium will be produced in the near future is earmarked for vital military programs. However, now that this remarkable material is out of the "wonder" material stage, it is not too early for the engineers and materials experts of the automotive industries to begin speculating as to practical applications for commercial use. As a matter of fact, exploratory decisions made soon should serve as a spur to accelerated activity on the part of titanium producers.

Atomic Energy

If the experts who surveyed the possibilities of atomic energy at the end of WW II had been right, we should be enjoying atomic power today. But we are dealing with matters that require time and vast outlay of money and many years of development. It was easier to create an agency of destruction than it is to harness it. At the recent SAE National Meeting, Walker L. Cisler, president of the Detroit Edison Co., viewed the picture with great clarity. His company and Dow Chemical are engaged jointly under contract in studying the possibility of using the heat of nuclear fission in industry. Cisler believes it will take five to 10 years to develop a commercial power plant for generating electricity. And at that time, the cost of generating power may not compare with the current practice of burning coal. It will require another stage of development, starting with the power plant of ten years hence, before comparable costs or possibly lower costs may be visualized.

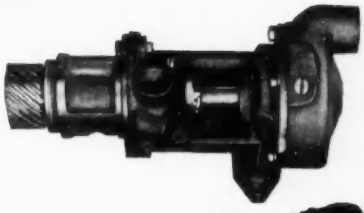
(*Turn to page 66, please*)

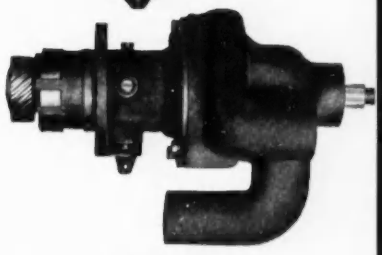
SCHWITZER-CUMMINS COMPANY

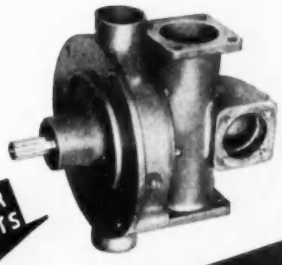
Specialists in

WATER and OIL PUMPS

A complete pump service for either your new production or for improving your present models. We offer an efficient pump—a fine impeller—or a superior automatic shaft seal.







We have been designing and building water and oil pumps since the pioneering days of the automotive industry. We started with it and have actively participated in every era of its development, so we are now "headquarters" for pumps for automatic transmissions and are building for some of today's famous ones. Our experience in efficient pump design, and where to apply fine workmanship is invaluable in this fast developing engineering field, for which nothing less than the very best and most suitable in materials and the closest possible tolerances and fine finishes will do.

Our long experience is yours for the asking. Let us tackle your job. You want either advantage in performance or price. We have both. We will take your assignment as an obligation to obtain for you a highly efficient performance at minimum cost.

At the top is illustrated a new development in constant pressure oil pumps for the many services where oil at high pressure and delivery is required.

Builders of Fine Pumps for 35 years

OTHER PRODUCTS

- COOLING FANS
- CRANK SHAFT VIBRATION DAMPERS
- AUTOMATIC SHAFT SEALS
- AIR STARTING MOTORS
- EXHAUST DRIVEN TURBOCHARGERS
- SUPERCHARGERS

SCHWITZER-CUMMINS COMPANY
1125 MASSACHUSETTS AVENUE
INDIANAPOLIS 7, INDIANA, U.S.A.

News *of the* Industry

(Continued from page 59)

French Output Set Mark Last Year

Falling just short of the half million mark, France set new automotive production records in 1952. The output comprised 370,500 passenger cars, 126,945 trucks and special road vehicles, and 2,109 buses and coaches. Agricultural tractors and motor cycles are not included in this total of 499,554. Productive order showed no change, being Renault, Citroen, Peugeot, Simca, Ford and Panhard. Production remained high and steady for the first ten months of the year, but dropped during November and December as the export market hardened.

Exports totaled 167,134 passenger cars, trucks and chassis, being a loss of 18,161 compared to 1951. Exports represented 21.5 of the total production. French makers are under no obligation to export any particular portion of their output. The country taking the greatest number of automobiles was Algeria, followed by Belgium, Morocco, Indo-China and Sweden.

Imports totaled 8,640 vehicles, compared with 13,397 a year earlier. Germany supplied 4,509 of these vehicles and 2,006 came from the United States. Germany lost heavily during the year, while American imports were only slightly down.

Italian Output Falls

Italian automobile production for 1952 showed a drop of 4.9 per cent from the previous year's figures. The total was 138,421, comprising 113,619 passenger cars, 23,259 trucks of all kinds, and 1534 buses and coaches. A slight increase was shown on coaches and heavy trucks, but there was a decline on passenger cars.

Exports from Italy were down 17.9 per cent, with a total of 26,460, composed of 25,007 passenger cars, 812 delivery vans, 507 trucks, and 134 buses and coaches. While the reduction covered all types of vehicles, it was greatest on trucks.

FORWARD CONTROL

Herman Body Co's new forward control body line will fit all chassis makes. Body and door width have been increased. Glass area is greater and service accessibility is easier.

Simca Cuts Aronde Price By Some Simplification

Simca, French automobile manufacturer, has clipped a fair amount off the price of the four-passenger "Aronde" sedan. While mechanical features and general construction remain unchanged, practically all chromium has been abolished, a cheaper type of upholstery has been adopted, and electric controls and equipment are simplified.

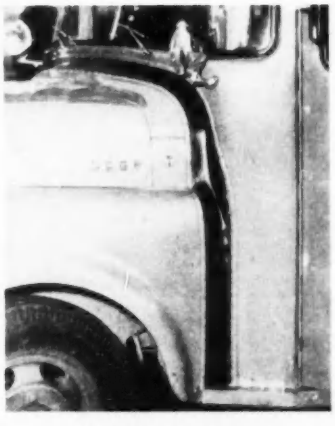
Renault introduced the "no frill" movement a few weeks ago, when it presented a rear engine model without chromium plating and without interior upholstery. It is believed that this simplification will attract new buyers who are more interested in purchase price than in luxury finish.

Soaring Fuel Taxes Curb Small Diesels

A concrete example of how taxes may stifle progress is the decision of a large truck builder to abandon plans for a smaller Diesel in its line. Taxes on Diesel fuel have already increased and more are pending to such a point that the company says the economies to the operator have been greatly reduced, particularly with reference to a smaller job. In fact, the reduction in economy margin resulting from greater taxes on Diesel fuel is a matter of considerable concern to all Diesel truck users.

Formsprag to Sell Own Clutches

Shepard Barnes, new president of the Formsprag Co., Van Dyke, (Detroit), Mich., announces the termination of a five-year sales agreement with the Morse Chain Co. for the distribution of Formsprag clutches. A staff of Formsprag sales engineers will now service the manufacturers of machinery, power transmission units, motor vehicles, and airplanes using Formsprag overrunning, backstop, or indexing clutches in their products. A network of distributors will carry standard sizes in stock.



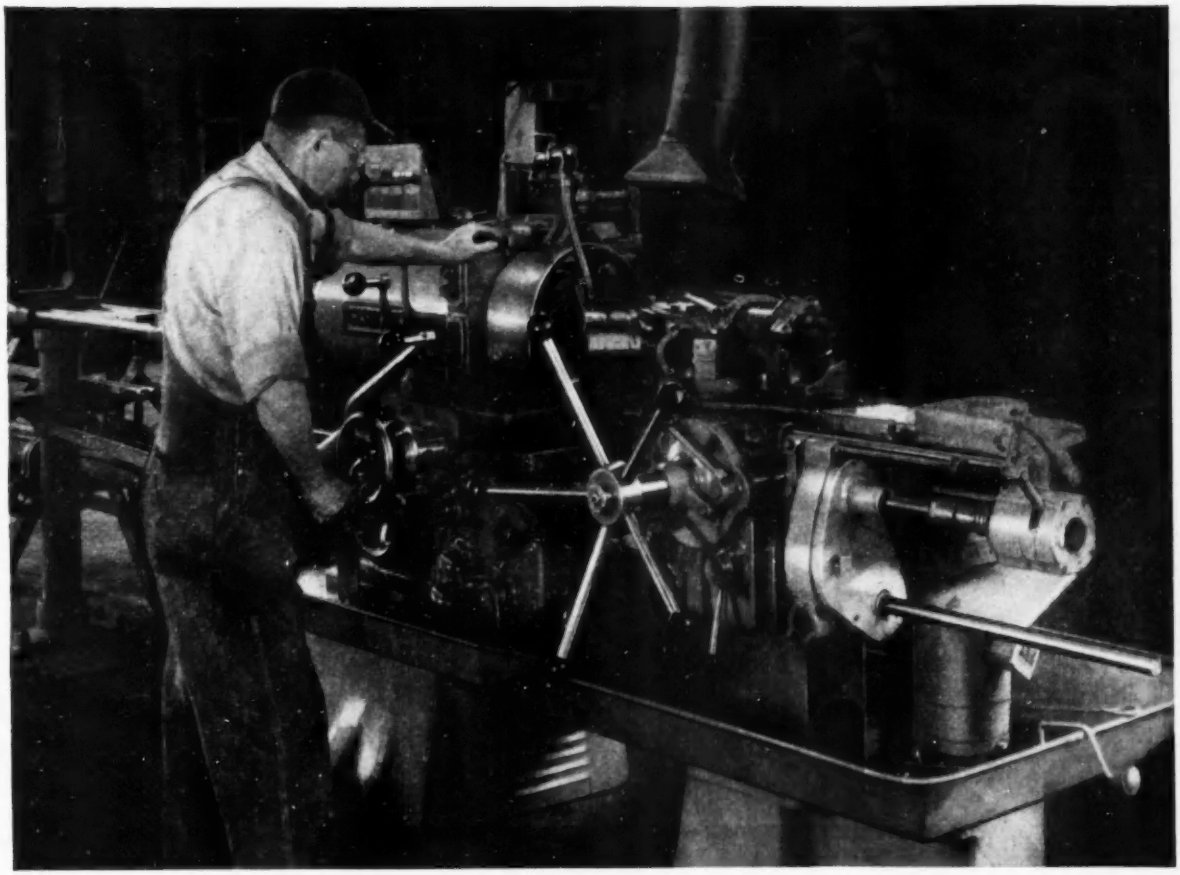
ABSORBS SHOCK

A hard rubber insert is used to isolate engine vibrations from the body of this special ambulance.

Twelve Months' Retail Car Sales Valued at $8,694,000,000*

	December 1952				Twelve Months 1952			
	Sales		Dollar Volume		Sales		Dollar Volume	
Price Group	Units†	% of Total	Dollars	% of Total	Units†	% of Total	Dollars	% of Tota
Under $2,000	223,560	56.29	$398,086,519	48.10	2,182,576	52.88	$3,858,309,241	44.38
$2,001 to $2,500	111,544	28.08	248,879,815	30.06	1,223,341	29.64	2,715,674,815	31.23
$2,500 to $3,500	47,723	12.01	127,435,902	15.39	540,344	13.09	1,454,590,134	16.73
Over $3,500	14,397	3.62	53,431,004	6.45	181,411	4.39	666,332,658	7.66
Total	397,244	100.00	$827,833,240	100.00	4,127,672	100.00	$8,694,906,848	100.00

*—Calculated on basis of new car registrations, as reported by R. L. Polk & Co., in conjunction with advertised delivered price at factory of four door sedan or equivalent model. Does not include transportation charges or extra equipment.
†—New registrations of American made cars only. Does not include imported foreign cars.



MACHINING FOR GOLD at Homestake

with Gisholt Turret Lathes

Yes, gold mining means machinery. And here at the famous Homestake Mine at Lead, South Dakota, Gisholt Turret Lathes help to machine the machines that dig for gold. It's a big job, too—turning out the variety of rock bits and drill rods that are used up in large numbers.

This Gisholt Ram Type Lathe was first used to turn the plain ends on the one-inch quarter-octagon drill steel for two types of rock bits. Production averaged 30 an hour. Now, the machine is also used to machine and thread three sizes of forged steel drill rods. Besides all this, the Gisholt has the job of facing and chamfering the chuck, or shank ends, of the drill steel so that a perfectly flat face is hit by the drill machine tappet.

Here, again, Gisholt Ram Type Turret Lathes prove their easy change-over and ability to produce profitably, even on small runs—big assets in any machine shop. Ask your nearest Gisholt representative about them. Or write us.

GISHOLT MACHINE COMPANY

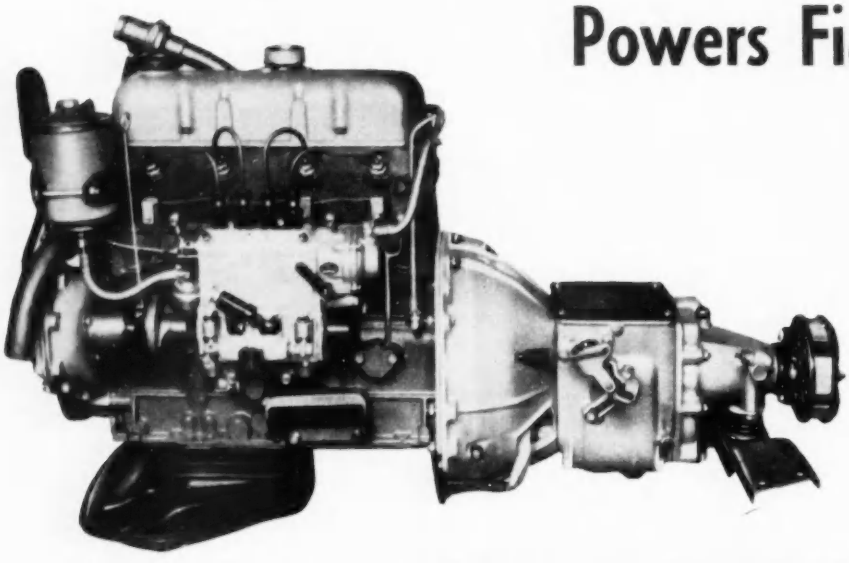
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE

represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

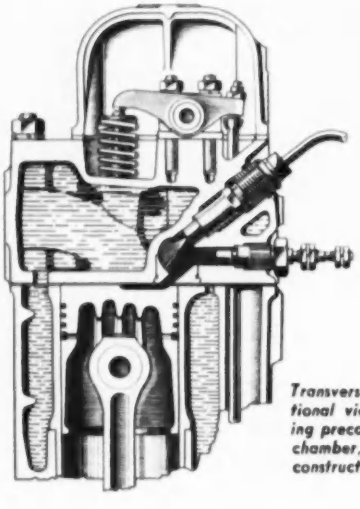
New Small Diesel Engine Powers Fiat Truck and Bus



Model 615N power plant. Weight of the four-cylinder, overhead-valve Diesel engine is 397 lb.

By W. F. Bradley
Special European Correspondent for AUTOMOTIVE INDUSTRIES

Fiat light truck powered by the new 116-cu in. Diesel engine.



Transverse sectional view showing precombustion chamber, piston construction, etc.

A FOUR-CYLINDER Diesel engine of only 116 cu in. piston displacement powers Fiat's newest truck and bus. Designated the 615N, the truck is designed for a load of 2350 lb while the bus carries 10 to 12 passengers. With a bore of 3.22 in. and a stroke of 3.54 in. the engine develops 40 hp at 3200 rpm. Compression ratio is 20 to 1, and injection pressure is 1850 psi.

Unlike the larger Fiat Diesels, this engine has a precombustion chamber of the Comet type, developed under Ricardo patents. The injector is mounted on the left side of the engine and driven from the forward timing gear. Construction features are: a three-bearing crankshaft; removable wet liners, vertically mounted valves with pushrod and rocker operation; a three-bearing camshaft driven by helical gears; and a belt-driven combined water pump and fan. The cylinder block and head are cast iron. Aluminum is used for the valve cover, as well as for the clutch housing and transmission case. The oil pan is sheet steel. Lubrication is full pressure, with a by-pass oil filter. Engine dimensions are 25⅜ in. length, 22½ in. width and 25½ in. height.

Engine speed is controlled by a pneumatic type governor and a butterfly valve in the intake manifold.

(*Turn to page* 80, *please*)

Bigge Drayage Co., Oakland, California, hauling 100-Ton Toulene Cracking Tower on special permit job.

The extra proven here . . . means LESS DOWNTIME on any hauling job!

Dependable Bendix-Westinghouse Air Brakes Provide Positive Control and Complete Safety on 100-Ton Move!

Safety and success on the tremendous job pictured above demanded the use of both specially devised equipment and techniques. But when it came to the vital task of braking, **standard Bendix-Westinghouse Air Brake equipment was the first and only choice!** That's because, year in and year out, on *all types* of hauling jobs, these mighty brakes roll up a remarkable record of **extreme durability and peak economy** unmatched by any other braking system in the field. And that's why, no matter what type trucks or buses you manufacture, you can make these same factors pay off for your customers, too, in increased efficiency plus **big savings on maintenance, parts replacement costs and reduced downtime.** So why not take advantage of it? Specify Bendix-Westinghouse, the world's most tried and trusted air brakes!

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE COMPANY
ELYRIA, OHIO • BERKELEY, CALIF.

Bendix-Westinghouse

THE WORLD'S MOST TRIED AND TRUSTED

AIR BRAKES

OBSERVATIONS

(*Continued from page* 60)

GM's Totals

The amazing growth of automatic transmissions was revealed in a statement made at the GM Motorama press conference in January. As of the end of 1952, GM divisions had produced a grand total of 5,750,000 automatic transmissions. When you add the production of Ford, Warner Gear, Detroit Gear, and Packard, the present record is impressive indeed.

Power Steering

Power steering is another major development that has taken the public by storm. In General Motors divisions alone, 15 per cent of car production in 1952 was equipped with power steering.

Plastic Bodies

Despite the problems of cost and manufacturing that must be resolved in the future for the production of plastic bodies, it must be emphasized that the new plastics formulations, particularly Fiberglas, have an exceedingly useful role to play right now. For one thing, plastics have been employed for the making of a relatively large number of experimental and show model sport cars. More important by far is the fact that when some of the motor car builders decide to launch special sports cars this year, they may make initial lots of say 250 in plastics before switching to steel for larger runs. Meanwhile, such preliminary production runs will go far to familiarize production people with the ultimate place of plastics in the picture.

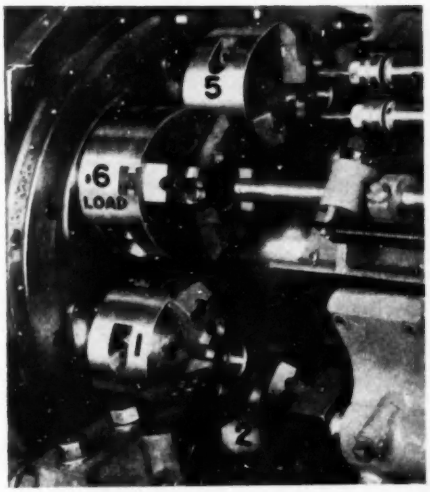
New Dow Antifreeze

Dow Chemical Co. is going into the antifreeze business. The company says it will package a permanent type antifreeze under private brand labels for its customers. In addition to ethylene glycol, the product will contain a new chemical concentrate for extra protection to motor vehicles. A national advertising program is being formulated.

ASK **BAIRD** ABOUT IT!

HIGH PRODUCTION TOOLING

A BAIRD CASE HISTORY



View of machine from front.

1
Finish turn flange O.D. (3.44"). Rough turn hub dia. Rough face flange and hub.

2
Chamfer I.D. Chamfer flange dia. and hub.

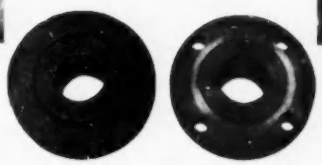
3
Finish turn hub, finish face flange and hub.

4
Drill and c'sink 4 holes — 23/64" dia. drill x 29/64" dia. C'sink, sub land drills. (Work held stationary when drilling.)

5
Tap 4 holes 7/16" — 14NC — 3. (Work positioned, held stationary, lead screw operated.)

6
Unload and load.

View of machine from rear.



The part . . .
before and after machining.

FINISHING A CAST IRON PULLEY HUB...

PRODUCTION

Cycle time 23.12 seconds per piece.
Gross production 155 pieces per hour.

Here's another example of the way a single Baird High Production Machine can be tooled to handle a series of operations ordinarily not considered practical on a single spindle automatic unit. Note that, in addition to the usual concentric operations being performed on this hub, we are drilling, countersinking, and tapping accurately located bolt holes in the hub flange at just two stations in the cycle and at a very satisfactory production rate for the whole operation. Photographs show the tooling and relative simplicity of the set-up.

And, as in the case of all Baird No. 76 Chucker installations, this one is conspicuous for smoothness and dependability of everyday performance. Automatic chucking frees operator's hands for efficient, easy feeding. Automatic safeguards prevent damage to work, machine, or injury to operator in case of incorrect loading. Spindle speeds are independently adjusted to best performance of the individual operation.

To step up speeds, quality of work, reduction in costs, check the Baird Chucker. "Ask Baird about it."

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1BA53

CALENDAR

OF COMING SHOWS AND MEETINGS

National Automobile Show, Montreal, Que., Canada....Feb. 27-Mar. 8

American Society for Testing Materials, Spring Meeting, Detroit, Mich. .....Mar. 2-6

SAE National Passenger Car, Body and Materials Meeting, Sheraton-Cadillac, Detroit, Mich...Mar. 3-5

Geneva Automobile & Truck Show, Geneva, Switzerland .....Mar. 5-15

Chicago Automobile Show, International Amphitheater, Chicago, Ill. .....Mar. 14-22

National Association of Corrosion Engineers Ninth Annual Conference and Exhibition, Hotel Sherman, Chicago, Ill. ....Mar. 16-20

21st Annual Meeting, American Society of Tool Engineers, Hotel Statler, Detroit, Mich. ....Mar. 18-20

Germany Vehicle Show, Frankfort, Germany .....Mar. 19-29

National Conference of Instrumentation, Michigan State College, E. Lansing, Mich. .....Mar. 19-20

27th Automobile Show, Civic Auditorium, San Francisco, Calif. Mar. 21-29

Eighth Western Metal Congress, Pan-Pacific Auditorium, and Western Metal Congress, Statler Hotel, Los Angeles, Calif. Mar. 23-27

SAE National Production Meeting, Hotel Statler, Cleveland, O. Mar. 25-27

International Magnesium Exposition, National Guard Armory, Washington, D. C. .....Mar. 31-Apr. 2

2nd Annual International Motor Sports Show, Grand Central Palace, New York, N. Y.....Apr. 4-12

Auto-Lite Easter Automobile Show, Waldorf - Astoria, New York, N. Y. .....Apr. 6-11

9th Annual Meeting and Show, Metal Powder Association, Hotel Cleveland, Cleveland, O. .....Apr. 20-22

SAE National Aeronautic Meeting and Aircraft Engineering Display, Hotel Statler, and Aircraft Production Forum, Hotel Gov. Clinton, New York, N. Y. Apr. 20-23

World Auto Show, Municipal Auditorium, Long Beach, Calif..Apr. 22-26

Annual Turin Automobile Show, Turin, Italy .....Apr. 22-May 3

British Industries Fair, London and Birmingham, England.Apr. 27-May 3

American Society of Mechanical Engineers, Spring Meeting, Deshler-Wallach Hotel, Columbus, O. Apr. 28-30

Fifth Materials Handling Exposition, Convention Hall, Philadelphia, Pa. .....May 18-22

Society for Experimental Stress Analysis, Spring Meeting, Hotel Schroeder, Milwaukee, Wis..May 20-22

American Gear Manufacturers Association, Annual Meeting, The Homestead, Hot Springs, Va. May 30-June 3

SAE Summer Meeting, The Ambassador and Ritz-Carlton, Atlantic City, N. J. .....June 7-12

2nd International Aviation Trade Show, Hotel Statler, New York, N. Y. .....June 9-11

Exposition of Basic Materials for Industry, Grand Central Palace, New York, N. Y. .....June 15-19

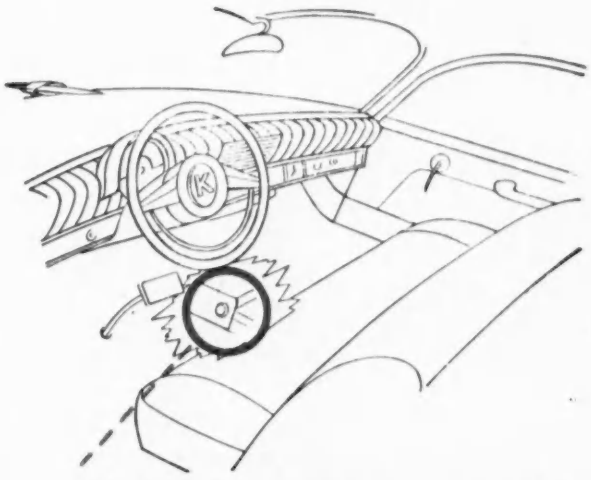
20th International Aeronautical Meeting, Le Bourget Field, Paris, France .....June 26-July 5

American Society for Testing Materials, Chalfonte-Haddon Hall, Atlantic City, N. J....June 29-July 3

Sixth Annual International Aviation Exposition, Detroit, Mich. ..July 9-12

National Aircraft Show and 50th Anniversary of Powered Flight, Vandalia Airport, Dayton, O..Sept. 5-7

Eighth National Instrument Conference and Exhibit, Chicago, Ill. .....Sept. 21-25



Du Pont nylon cuts noise in Kaiser clutch assembly

Bearing molded by
The Danielson Mfg. Co., Danielson, Conn.,
for Kaiser-Frazer Corp.,
Willow Run, Mich.

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living
... through Chemistry

Polychemicals
DEPARTMENT
PLASTICS • CHEMICALS

Nylon bearing needs no lubrication . . . eliminates electrolytic corrosion

In designing their 1952 models, Kaiser engineers sought a material for the clutch cross-shaft bearing that would eliminate noise. But all the materials tested had the same faults. They were noisy, had to be oiled and wore quickly because of electrolytic action.

The answer was a bearing molded of Du Pont nylon. According to K-F, nylon was selected "because of the ability of the nylon bearing to operate without lubrication and the absence of electrolytic corrosion." Noise has been eliminated. And nylon's abrasion resistance and unique bearing characteristics have resulted in improved clutch performance.

Du Pont nylon is unaffected by gasoline, oil and grease . . . operates at temperatures up to 250°F. Nylon parts can be economically mass-produced to close tolerances by rapid injection-molding.

The outstanding advantages of Du Pont nylon are improving performance and cutting costs in a number of automotive parts, such as clutch and brake bumper seals, windshield wiper gears, and lamp lenses. Its properties may well be of value to you. For full information, write:

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Polychemicals Department; District Offices:
350 Fifth Avenue, New York 1, N. Y.
7 S. Dearborn Street, Chicago 3, Ill.
845 E. 60th Street, Los Angeles 1, Calif.

New Products

For additional information please use postage-free reply card on page 49

(*Continued from page* 48)

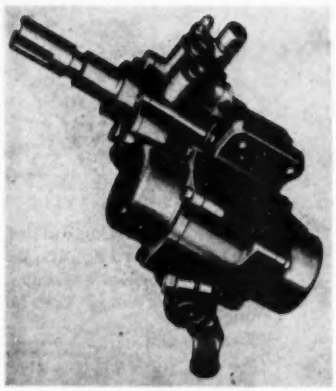
independently by either foot pedal or hand lever from a separate source of fluid pressure.

Installation of the brake can be made on most standard vehicles without modification of existing axles or drums, according to the maker. The brake and its operating mechanism are contained completely within the drum. One of the units is shown installed on the Army BARC amphibious cargo carrier. *Fawick Brake Div., Federal Fawick Corp.*

Circle P-7 on page 49 for more data

Power Steering Gear

A weight reduction from 58 to 32 lb, the elimination of 30 parts and much machining eliminated, and a simplified assembly are said to result from redesign of the Hydraguide power steering unit.



Details of the new design include: an aluminum housing cored to eliminate external tubing; die-cast aluminum valve body; powdered-metal valve operating blocks; flange-bolted cylinders instead of screwed; die-cast aluminum pistons; and new adjustment on worm. Operating parts now are automatically lubricated by the same oil used in the hydraulic circuit to eliminate need for special greasing. *Gemmer Mfg. Co.*

Circle P-8 on page 49 for more data

INDIVIDUALLY PLANNED motor control centers are manufactured and delivered completely wired and ready-to-install from this new General Electric motor control center production line.

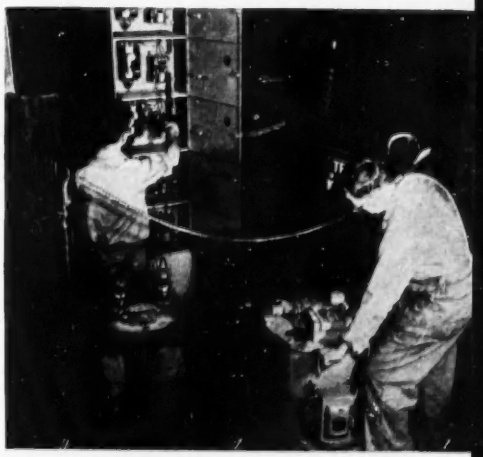
EASY TO INSTALL, inspect, and interchange starters, which are assembled as complete units, including pushbuttons and wiring terminals for easy front-connecting. Door swings more than 90°

New G-E Motor Control Center Has Easiest-to-Interchange Units

The new General Electric motor control center is the most up-to-date equipment for the centralized control of a-c motors up to 200 horsepower. Each control center is planned for the job it is to handle, but it can rapidly be modified to meet changed requirements. Standard units can be easily interchanged or substituted, new units can be quickly added. Units may be mounted back-to-back in same standard enclosure. Master terminal boards may be located at either top or bottom of cabinet.

ACCESSIBLE. Installation is simple—just a matter of sliding the unit into its compartment. Stab-on connectors grab the vertical bus. Wiring is easy because even pushbuttons and terminals are mounted on the unit frame for simple front-connecting. Doors swing more than 90°, so unit can be lifted out of compartment for accessibility from all sides. Barriers between units can be slipped out, making a four-inch wiring trough. Master terminal boards can be swung out of place for connecting without "fishing" of wires.

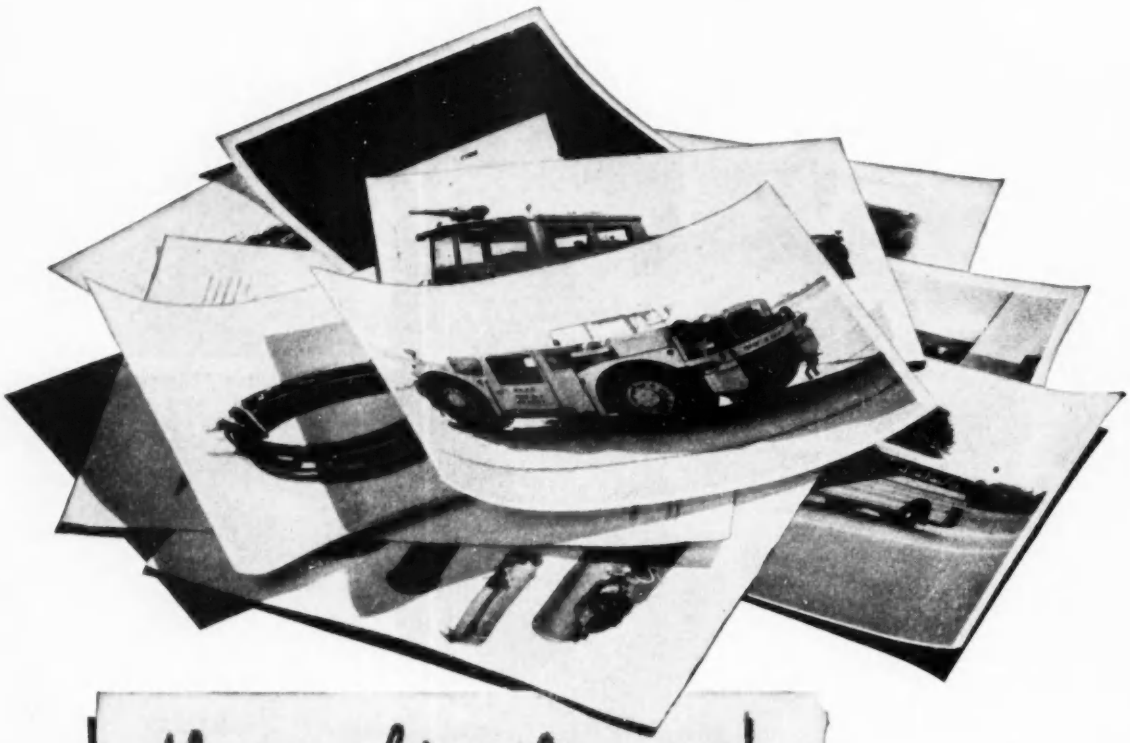
FOR MORE INFORMATION, contact your nearby General Electric apparatus sales office, authorized G-E agent or distributor, or write Section 781-1 for GEA-4979A today. *General Electric Company, Schenectady 5, New York.*



HIGH-POTENTIAL TESTS are made of each completed General Electric control center before shipment, to assure adequate short-circuit protection, safety for plant personnel and equipment.

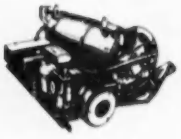
You can put your confidence in—

GENERAL ELECTRIC



the proof is piling up!

Janitrol liquid heater-equipped bomber tow tug starts reliably after 72-hour cold soak at minus 65°F, without special fuel capsules. Engine temperature raised to 155°F in 60 minutes . . . Heater specifications on Air Force crash truck met in full by Janitrol heater, which provides heat for defrosting, cab comfort, auxiliary generator, and main water supply . . . Stationary diesels winterized by Janitrol . . . Transit operators report Janitrol-equipped coaches run longer between overhauls, substantially reduce maintenance . . . The proof is piling up: that Janitrol heaters pay off the original investment in lower maintenance and positive, all-weather dependability.



"Janitrol liquid heater equipped" means dependability—proved for seven years

KNOWN THE WORLD 'ROUND

Janitrol

AIRCRAFT-AUTOMOTIVE DIVISION SURFACE COMBUSTION CORP., TOLEDO 1, OHIO

F. H. Scott, 225 Broadway, New York, N. Y. • C. B. Anderson, 2509 W. Berry St., Ft. Worth, Tex. • L. A. Curtin, 7046 Hollywood Blvd., Hollywood, Calif. • F. H. Scott 4650 East-West Highway, Washington, D. C. • Phil A. Miller; Frank Deak, USAF Coordinator, Central District Office, 400 Dublin Ave., Columbus, Ohio • Headquarters, Toledo, Ohio

Effects of Piston Pin Offset

(*Continued from page* 31)

tional to the effective force on the piston (gas pressure —inertia), this force can be given an arbitrary value, and we will make it equal to 1000 lb. The force on the connecting rod then is equal to 1000/cos 12 deg = 1000/0.978 = 1023 lb, and the side thrust on the cylinder wall, 1000× tan 12 deg = 1000 × 0.212 = 212 lb. This side thrust is divided between the upper and lower edges of the piston skirt in the inverse proportion of their distances from the piston-pin axis. That gives approximately 152 lb for the upper and 60 lb for the lower edge.

Now, the resultant of the gas pressure and the inertia force acts along the piston axis, from which the piston-pin axis is offset 0.12 in., hence that force creates a moment of 1000 × 0.12 = 120 lb-in. around the piston-pin axis. With a moment arm equal to the distance from the piston-pin axis to the lower edge of the skirt, 2.04 in., this implies a force of 120/2.04 = 59 lb, which tends to separate the lower end of the skirt from the "off" side of the cylinder wall. This is almost exactly the same as the force (60 lb) due to the angularity of the connecting rod, which tends to hold the lower end of the skirt in contact with the "off" side of the cylinder wall.

Therefore, obviously, as the force due to connecting-rod angularity is decreasing rapidly, while that due to the moment is increasing by reason of the increase in the gas pressure toward the end of the compression stroke, movement of the lower end of the piston skirt is about to begin. Piston-pin bearing friction has been neglected here, which seems to be permissible in view of the fact that the test engine had a needle bearing on the pin.

In the paper on which most of the foregoing is based the treatment is carried farther, the actual values of the impulses, in lb-sec, being calculated for the test engine under full throttle at 1300 rpm, for six different offsets and three different piston clearances. The results are plotted in diagrams similar to Figs. 6 and 7. See page 30.

With an offset of + 0.12 in. the impulse of upper end of the skirt is about three times as great as the impulse of the lower end. The impulse, of course, increases with the clearance. For that reason, if there is any piston slap, it is most audible when the engine is cold, because the clearance between piston and cylinder wall is then a maximum. For a given throttle position the intensity of the slap decreases as the speed increases, but the slap increases with the throttle opening.

It was found that with an optimum offset of the piston pin an engine will run without audible slap even if the piston clearance is increased to twice that normally specified. Piston slap usually increases with the service life of an engine.

SHORTIES

Advances made in performance and frequency of design changes by the military resulted in 2100 engineering changes between the first and nineteenth new jet engines produced by a major U. S. manufacturer.

•

Only $1386 of the payment made for a $2000 car is for the car; the remaining $614 is for taxes as follows: manufacturers' taxes, $155; suppliers' taxes, $154; dealers' taxes, $102; sales taxes (average), $57; and federal excise tax, $146.

•

In 1900 the average employee in the U. S. made 43 cents an hour, in terms of 1949 prices. Fifty years later the average was $1.43.

•

U. S. industrial research was carried on by 300 laboratories with 9000 employees in 1920. Twenty years later there were 2200 laboratories with more than 70,000 employees.

•

U. S. light plane manufacturers have built more than 10,000 single-engine, four-place aircraft since 1948.

•

Germany is now producing motor-powered rickshaws for export to Asia which will speed up to 30 mph.

•

Studies of long-range national trends indicate that 1960 automobile registrations will jump to 50 million from today's 40 million registrations. The average driver will spend 25 per cent more time behind the wheel in 1960 than he did in 1950.

•

To build a jet engine in 1947 required 5250 tools; to build the much more powerful jet engines of today requires 20,000 tools.

•

The automotive industries and highway users pay approximately one out of every eight tax dollars collected in the U. S.

Drive-in Deep Freezer Tests Aluminum Automotive Products

40° below zero cold room serves designers and project engineers

Arctic temperatures, homemade in Alcoa's laboratories, sped aluminum piston development. Many aluminum pistons were tested by parka-clad Alcoa engineers for cold-scuffing, noise-level, and expansion characteristics. Now, aluminum pistons are standard equipment in all '53 makes.

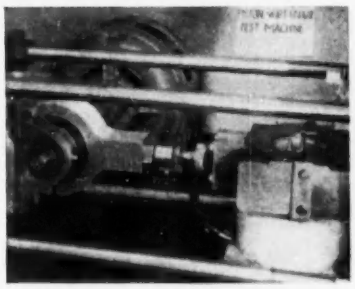
Alcoa's frigid proving ground helped meet Army deadlines for a new tank crankcase . . . clipped weeks from the development time of new valve lifters . . . found the cold-weather starting secrets of foreign diesel engines.

Like all of Alcoa's research and development facilities, our drive-in deep freezer is available to help you apply aluminum's advantages to your automotive product. To get in touch with the Alcoa engineering specialists in your field, call the nearest Alcoa sales office. Or write directly to us, outlining the project you have in mind.

Alcoa Aluminum

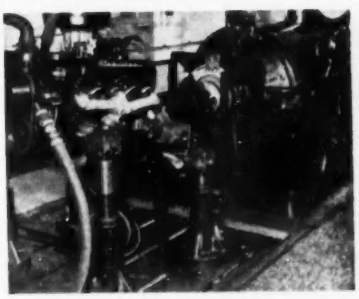
ALUMINUM COMPANY OF AMERICA

ARE YOU TAKING ADVANTAGE OF THESE FACILITIES?



Development work on aluminum pistons continues with fatigue tests on this special machine built by Alcoa.

Engineering specialists conducting torsion tests of a stiffened aluminum alloy cylinder.



One of Alcoa's battery of dynamometers for testing internal combustion engines.

ALUMINUM COMPANY OF AMERICA
1841-C Alcoa Building
Pittsburgh 19, Pa.

Please send me a copy of your "Road Map to a Better Product" outlining Alcoa's research and development facilities.

Name_____

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Company_____

City_____

State_____

An Analysis of Reinforced Plastics

(*Continued from page* 40)

are still in a development stage and it must be remembered that the configurations that are "born" on the design board must be carefully "reared" through a suitable testing program.

A set of typical design studies are illustrated to indicate various approaches to attachment problems. When high unit loads are involved the lower bearing values and delamination properties become a problem that must be considered. When this circumstance exists, the designer may, by the configurations indicated in Figs. 1 through 5, retain reasonably high effective properties by transferring high skin tension loads from the plastic reinforce laminate structure through metallic fittings or directly into another structure without the use of an intermediate material. When bolt or rivet patterns are considered, careful attention must be given to the poor load-distributing properties of plastic reinforced laminates and the difference in the elastic modulus and thermal modulus between it and metallic fittings. When the designs unique to laminated structure are used, the low bearing values and delamination troubles are circumvented.

When the plastic reinforced laminate can be pressure formed, appreciably higher values for all physical properties can be expected than those obtainable from cold bond with only contact pressures. The individual physical configuration of each design presents a new set of considerations for the fabricator. It is therefore very necessary that the designer not attempt to work independently of the process representative.

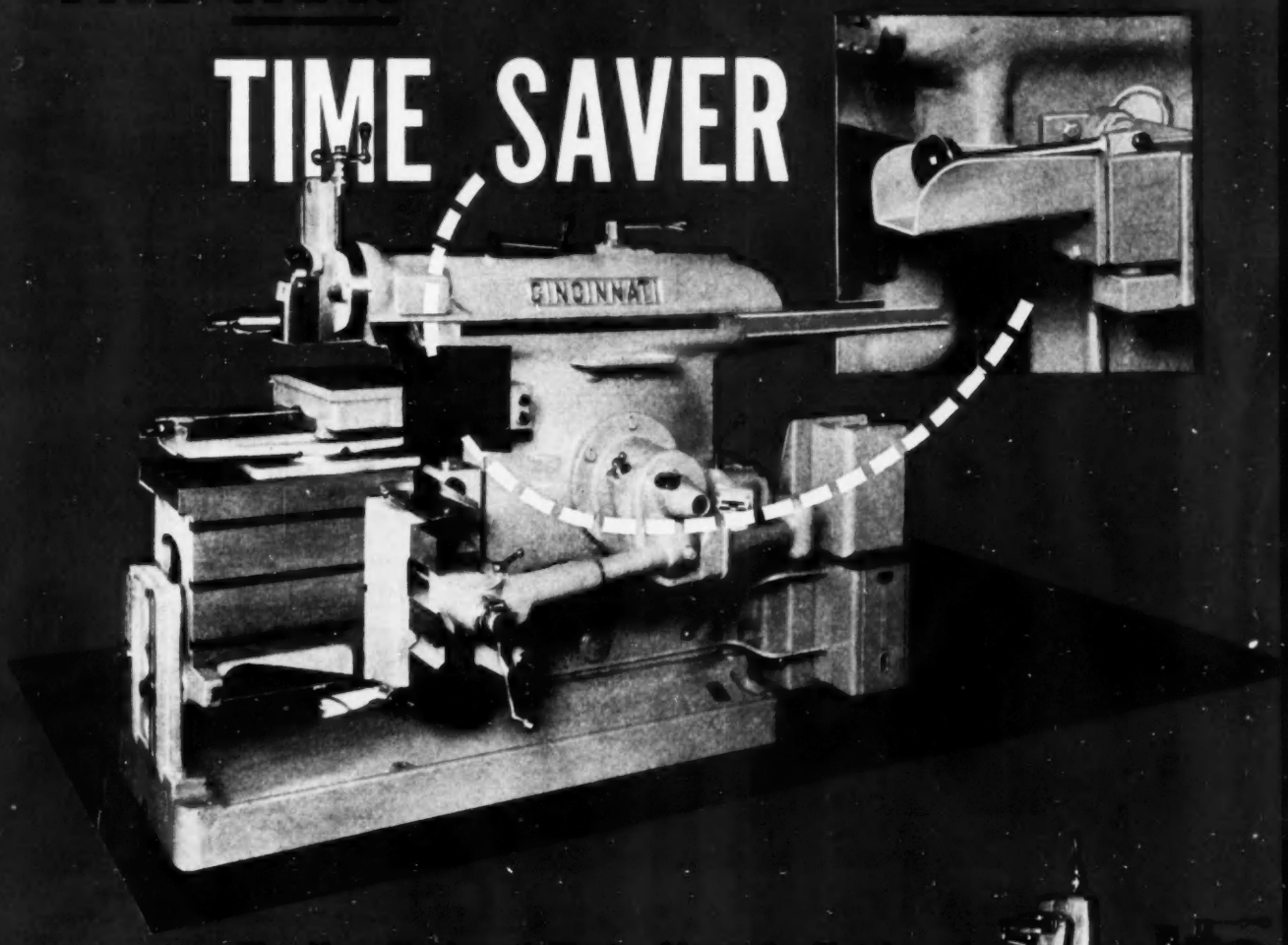
The usual tool of the stress analysis, Poisson's ratio, cannot be used without caution due to the orthotropic properties of reinforced plastic. This must be replaced or augumented by test data from the Process Laboratory on the specific design configuration under consideration. Some assistance can be obtained by a selection of one or more types of cloth available, and augmenting the laminated properties by a basket weave of the plies of woven cloth. This is illustrated in Fig. 4. The immediate area can be made of laminations of cloth fabric woven from heavier yarns using a pronounced pattern "S" curve in weaving. This produces a low effective modulus in the immediate area of the attachment fittings, but produces a shock absorbing property with some load-distributing characteristics that the other portions of the structure do not possess.

Comparisons should be made to determine the possible advantages to be gained with plastic construction over conventional methods of design. The comparison, if first made with an optimum metal structure, will more clearly indicate the advantages or disadvantages to be expected from the redesign, using metal and plastic combinations, or all plastic structures.

The elimination of skin splices and spar splices by the use of reinforced laminates is shown in Fig. 6 when the molded "T" sections are used to

THE NEW

TIME SAVER



The New Cincinnati Electro-Magnetic Clutch and Brake alone brought a 30% time-saving here . . .

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

form an original composite or angle for bulkhead or rib attachment. The molded stiffener is used in the skin for improved joint efficiency. This design enables a much higher moment and shear allowable to be used for the attachment of the former than could be obtained by riviting or cold bonding the formed angle or "T" section to the inside face of the skin.

For structural service requirements involving fuel cells, the plastic reinforced laminate lends itself very well to sealed units. The joints of irregular shape can be successfully fabricated and successfully sealed.

The structure showing a butt joint of a wing skin and the two stages of study planning are shown in Figs. 7 and 8. Under the conditions of a complex sheet metal rivited joint, note the simplicity of construction in which the plastic reinforced laminate is able to reduce or eliminate the stress concentrations in this critical area. The elimination of the eccentric loads in the troubled areas enables the designer to more nearly approach the desired optimum design. The illustration in Fig. 8 shows the elimination of the doubler plates, angles, and rivets, etc. This reduces the man hours required for detail design, tooling design, tooling fabrication, part fabrication, process follow-up and numerous inspections.

The designer may circumvent the orthotropic properties of plastic bonded reinforced laminates that are normally considered as uniform laminates. The edges of these sheet materials or block structures are subject to delamination. This weakness is eliminated, or reduced, as shown in Figs. 2 and 4. This design indicates how a proper treatment of the material will allow maximum pullout strength of a fitting. This treatment is similar to a basket weave. The cross lamination or spiral will not reduce the delamination tendency adequately.

The plastic reinforced laminate type of construction enables the designer to use compound tapered skin thicknesses with bonded spars, ribs and longerons.

The spars, ribs and longerons can be formed of sandwich construction as can the skin proper. In some instances, with relatively thin wing sections carrying bending loads in the skin, the rib formers, longerons, and spars can be replaced by load-carrying, low-density foamed or honeycomb material to fulfill all shear requirements. These materials must be bonded to the skin to obtain an installation having maximum efficiency.

(*Turn to page* 80, *please*)

Another new development using

B. F. Goodrich Chemical *raw materials*

Bellows for Piasecki HUP helicopter molded by Surgical Rubber Co., Norristown, Pa. B. F. Goodrich Chemical Company supplies the Hycar rubber only.

'copter crews like Hycar "umbrella"!

LIFE at sea isn't always smooth-going for these HUP helicopters. They operate under all sorts of weather and service conditions—must have unique parts and devices to help keep 'em flying efficiently.

One of these important devices is a rotor spinner bellows made of Hycar rubber. It operates with the propeller pitch control link—flexes and twists as the rotor blade angles change—shields the rotor head controls from rain and salt spray. Acts like an umbrella!

Naturally, Hycar rubber is an ideal material for a job like this. For Hycar has great resiliency and strength, plus extreme resistance to heat and cold, aging, abrasion, gas, oil and many chemicals. In this bellows, Hycar meets military specifications MIL-R-6855, Class I and II.

One of the many Hycar rubber compounds may answer a problem for you—help you develop or improve more saleable products. For information, please write Dept. HG-3, B. F. Goodrich Chemical Co., Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar
Reg. U.S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

In such instances as might require an ability to receive a high concentrated load from an attachment member, the laminations can be increased in the local area, replacing the low-density material. This flexibility of design is a valuable aid to the designer in the constant conflict of weight reduction vs. stress concentration in irregular areas.

An appropriate application of reinforced laminate is its use for structures requiring stability and low elastic modulus for shock absorption. The fact that reinforced plastics have nearly coincident yield and ultimate stresses, indicates that the structural material will either completely spring back to its original shape or will fracture. This can be an advantage in many designs involving shock loading where temporary deformation can be tolerated.

When structures are designed that require flotation as well as strength, such as water borne equipment, the proportional amount of foamed plastic material can be chosen in such a manner that the unit will have the proper water displacement. This can also be true of honeycomb when it is properly bonded to other structure in such manner that all cells are sealed at each end.

Some success has been experienced at Northrop Aircraft, Inc., with the use of aluminum castings bonded as an integral part of the reinforced structure. The bonding resin adheres satisfactorily and does not present a problem when small parts are considered. In the case of large parts having dimensions in excess of two ft., a consideration of the thermal coefficient for each material is necessary.

Summary:

The preceding discussion on glass fiber reinforced plastic structural material for elevated temperature service requirements can be summarized as follows:

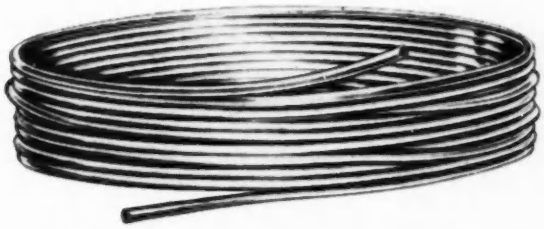
(1) Reinforced glass fiber laminates are in the low density class of structural materials.
(2) The comparative cost of the finished high production part is low.
(3) The producibility possibilities of reinforced glass fiber laminates are excellent.
(4) When unidirectional loads are high, they can be balanced by selecting high unidirectional property reinforced glass fiber laminate.
(5) When isotropic properties are required, random fiber mat can be selected.
(6) A variety of flexure modulus can be designed into a structure, as required.
(7) Reinforced glass fiber laminate has excellent shock absorption properties.
(8) Complex curved surfaces can be easily fabricated.
(9) Weight can be reduced by the use of honeycomb or foamed plastic in sandwich construction.
(10) High pressure forming produces better physical allowables than low pressure forming.
(11) Some forms of glass fiber reinforced laminate do not allow the use of Poisson's ratio for considering the structural analysis.
(12) Conventional design must be modified for proper joint attachment fittings.
(13) Flexibility of design in glass fiber can be used as a valuable aid.
(14) Field service of parts is simplified.

Small Diesel

(*Continued from page* 64)

Operation of the accelerator pedal controls the butterfly valve and alters manifold pressure, thus shifting the pump regulator rod and varying the rate of fuel delivery. Because of the small dimensions of the engine, a single jet injector is used. Fuel consumption is said to be 0.43 lb per hp hr.

Apart from its power plant, the truck follows standard lines, with forward mounting of the engine, a plate clutch, four speed transmission, and open drive shaft to the spiral bevel rear axle. Front wheels are independently sprung and semi-elliptic springs are used at the rear.



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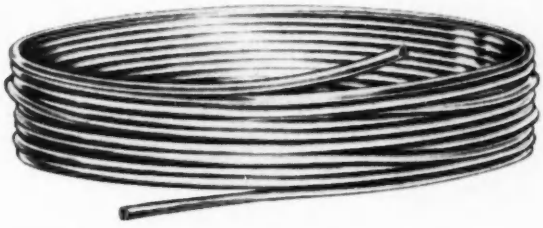

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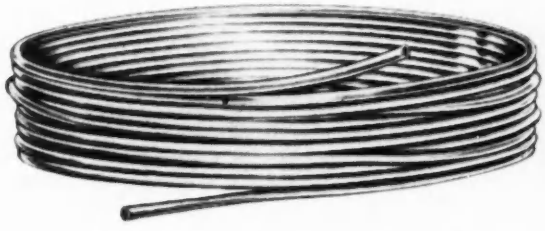

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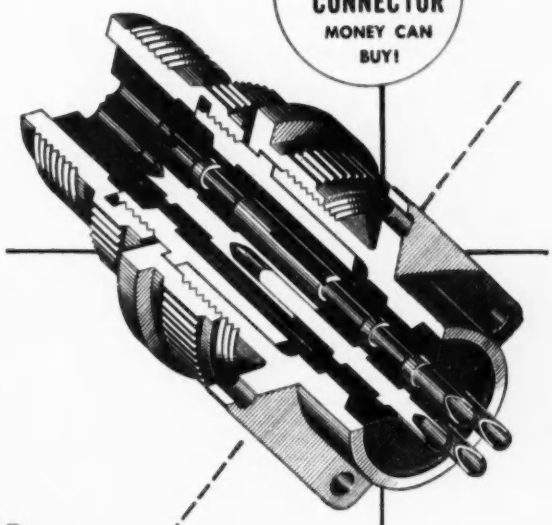

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METALS——

(*Continued from page* 58)

stability of the market. European zinc markets are weak with the metal available at about 10¼ cents per lb. Net imports of zinc in 1952 are estimated to have been close to 500,000 tons, about 150,000 tons more than in 1951. Steadily increasing production of zinc ore in Canada strengthens belief that zinc imports will continue large in 1953.

Zinc futures reflect the uncertainty. On the New York Metal Exchange future positions for zinc are generally selling about ½ cent or more below the spot price for the metal. Buying for the Government account was almost negligible in January and it is generally believed that stockpile supplies are adequate.

Tariff Relief for Zinc and Lead Proposed

The slump in zinc and lead prices has brought out demand for tariff relief and officials of St. Joseph Lead Co. have given their support to an ingenious sliding scale tax on imports. Under proposed provisions, a sort of parity price would be set up, with foreign metal admitted free when the domestic price exceeded parity, but a tax of ¾ cent per lb to be imposed for every one cent decline below parity. Tentatively 16 cents per lb was suggested for the parity price at which it is thought the markets would ultimately stabilize.

It appears rather doubtful that this proposal will win favor at Washington because of the expressed reluctance to raise tariff walls against friendly countries, and in this instance both Canada and Mexico would especially be affected. But if further price declines ensue, no doubt more pressure will be brought to bear. It might be inferred that about 15-16 cents per lb is regarded by St. Joseph Lead as a fair domestic price for both metals. The present import tariffs of 0.7 cent per lb for zinc and 1.06 cent for lead have not had much effect on rate of imports.

Higher Price for Aluminum

The Office of Price Stabilization authorized an increase of ½ cent per lb in primary aluminum effective January 22 which brought the price up to 20½ cents. This was not entirely satisfactory to producers. However, it represented a substantial

guarantee of their long term earning position as the Government contracts to buy their entire output from new facilities for five years if it cannot be sold elsewhere at this price or higher.

U. S. production of primary aluminum approximated 938,000 tons in 1952, an increase of about 100,000 tons over 1951. Had it not been for the power shortage in the Northwest last year, production would have been considerably larger. Total capacity by 1955 when all the expansion program is completed will be about 1,750,000 tons.

Price decontrol will probably mean an increase of about one cent per lb for pig aluminum and an additional five per cent increase for aluminum fabricated products. Neither increase will displease zinc producers who will find their competitive position improved by a higher price for aluminum.

No Wide Increase in Steel Prices Expected

No across-the-board rise in steel prices is anticipated when controls are lifted, but some adjustments will be made to correct unbalanced situations. OPS officials are quoted as forecasting hikes of about three per cent for carbon steel and about nine per cent for stainless and other alloys because of ceiling increases in nickel, ferrochrome, and ferro manganese.

January was the best month in steel history. The industry operated at 99.5 per cent capacity at the new rate of 117.5 million tons a year. Producers were busy trying to catch up with delayed deliveries and heavy current demand. Most observers agree that the industry will operate at or near capacity at least through the second quarter.

Some concern is expressed over the increasing competition from European steel manufacturers who are making every effort to regain lost markets. Europe's total steel output in 1952 was 109 million tons, the highest ever recorded, and its capacity continues to increase.

National Production Authority has removed all controls over the uses and inventories of tin by the simple expedient of revoking five orders: M-8; M-24; M-25; M-26; and M-27. This means that the only control now retained by NPA over tin is the reporting requirement under which consumers and dealers must continue to list monthly receipts, shipments, consumption, and stocks.

Acting Administrator H. B. McCoy

said the supply of tin contracted for and otherwise obtainable in world markets is now foreseen as sufficient to meet demands for both defense and civilian goods.

Foamed Plastic

(*Continued from page* 41)

from the punch die. This is illustrated in Fig. 3.

Another application for Lockfoam is to strengthen an aileron section of the F-94C Starfire. As shown in Fig. 4, three members of Lockheed's plastics department pour the Lockfoam which begins foaming immediately after 1½ minutes of premixing. Temperature of the metal aileron surface is brought to 120 F for preheating, and heat produced during the chemical action raises it to 200 F. After pouring the curing cycle takes seven hours. The steam-heated jacket which holds the aileron is encased in metal-sprayed, copper steam coils.

Valve Mechanism

(*Continued from page* 27)

design and moves the pressure regulator valve to supply a lower main line pressure with low engine loading in Drive. The governor pressure lowers the main line pressure at high speeds. If the engine is heavily loaded for a forced downshift, the vacuum modulator tends to move the pressure regulator valve for a higher main line pressure. This action is opposed by the governor pressure so that the low band is not applied too drastically as the shift valve moves to the low range.

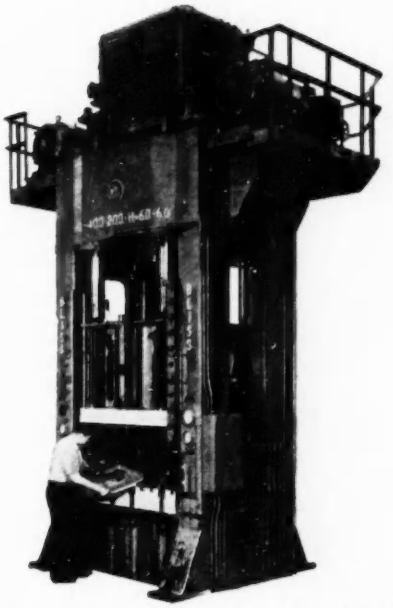
Governor modulation of the main line pressure also provides smoother upshifting at low throttle by reducing the line pressure for a softer clutch application.

The vacuum modulator is inoperative and the governor pressure is cut off when the selector lever is placed in Low or Reverse since a higher main line pressure is required in these positions for a firm band application.

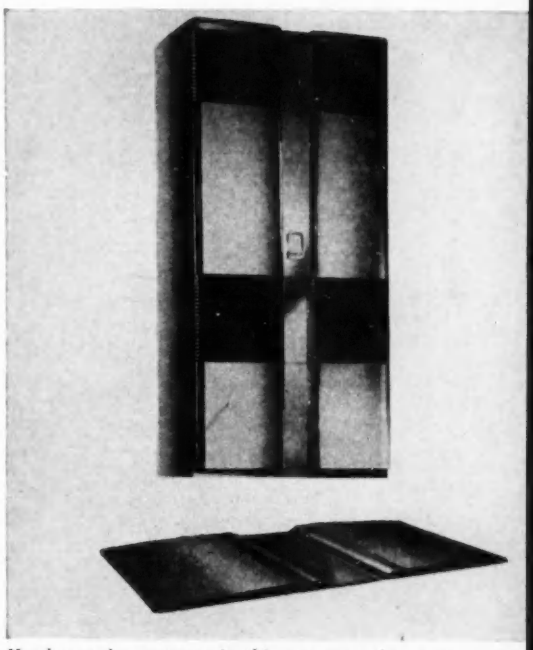
BOOKS . . .

MANUAL OF ENGINE TEST METHODS FOR RATING FUELS, *published by American Society for Testing Materials*, 1916 Race Street, Philadelphia 3, Pa. Price, $8.00. The second edition of this 360-page manual incorporates all of the changes in the five standard methods for rating motor, aviation, and Diesel engine fuels that have been adopted since their earlier publication in 1948. The six extensively revised supplements contain information on the best practices currently in use for laboratory facilities, installation of the engine test units, provisions for reference materials and electrical, water and air services, and the operation and maintenance of the units. An important improvement in the manual is the inclusion of an extensive index. Users will find the index of considerable service in locating needed information quickly and conveniently. Two methods which apply to motor fuels describe the test procedures for determining the knock characteristics of fuels for use in spark-ignition engines, the first in terms of ASTM Motor octane numbers, the second in terms of ASTM Research octane numbers. An important modification in the "Motor" and "Research" methods provides for the use of a detonation meter as an alternate for the "bouncing pin" described in the earlier edition to determine knock intensity. Two methods which apply to aviation fuels, describe the test procedure for determining the knock characteristics of fuels for use in aircraft engines of the spark-ignition type, the first at a lean fuel/air ratio, the second at knock limited power under supercharge rich-mixture conditions. The last method which applies to Diesel fuels, describes the test procedure for determining the ignition quality of Diesel fuels in terms of ASTM Cetane number. All of the methods have come into widespread use and are of great industrial significance, not only to the suppliers of fuels, but also to users of fuels and designers of engines.

The trend is to more stampings WITH BLISS PRESSES...



1200 14-gauge drip pans are drawn and formed daily in this Bliss press which has a 400-ton blankholder pressure and 200-ton plunger capacity.



Hard-to-make contours in this center-section stamping for a Weathermaker are drawn from 20-gauge steel at the rate of 1800 daily.

Versatile Bliss Hydro-Dynamic Allows Unusual Metal Design

A new 600-ton Bliss double-action Hydro-Dynamic press helps Carrier Corporation produce nice-to-look-at but tough-to-make contours for its line of air conditioners.

Carrier's Vice President of Manufacturing reported that, "By varying ram, blankholder and cushion pressures and the draw cycle, we have been able to complete difficult drawing operations with sharp corners and small radii at the bottom... Actually, the press has exceeded our expectations."

Top performance? Of course—but it's all a matter of picking the proper press. It's what Bliss engineers mean by "the *right* press for the job."

Top panel for window-model Room Air Conditioner has intricate contours, sharp corners and bottom radii. Yet Carrier was able to produce them at the rate of 1200 per eight-hour shift.

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Weight Reduction in Trucks

(*Continued from page* 46)

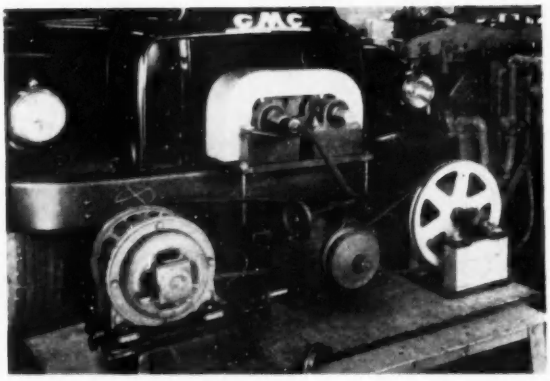

Fig. 3—Vibration machine for testing certain truck components.

gear and shaft. Both gears have weights attached to them which meet at the center every revolution. Thus vertical forces are created by the machine and the period of these forces can be varied by changing the speed of rotation.

When the vibrator is rigidly attached to the front bumper of a truck as is shown, the entire vehicle can be vibrated at different speeds and the natural periods of various parts can be readily determined.

If the natural period of some component is the same or nearly the same as that of the tires (500-600 cpm), this component will surely cause trouble. Any change which will bring the natural period of units definitely out of the range of the tires will eliminate the possibility of trouble.

We have even corrected difficulties reported in that all-inclusive term called "shimmy" by using the vibrator to locate the flexibility which was responsible.

Figure 4 shows an endurance test on engine timing gears which are located inside the timing gear cover on the right. In the driving shaft which is connected to the crankshaft gear is a small flywheel and a double jointed propeller shaft. The joints in this shaft are assembled 90 deg off the conventional manner. Further, the shaft is running at quite an angle. This sets up an uneven rotation in the crankshaft gear. Inside the box and connected to the camshaft gear is another small flywheel which provides some resistance on the driven gear to the uneven rotation of the driving gear. The severity of this test can be increased or decreased by changing the angle of which the joints are run or by changing the weight of the flywheel connected to the driven camshaft gear.

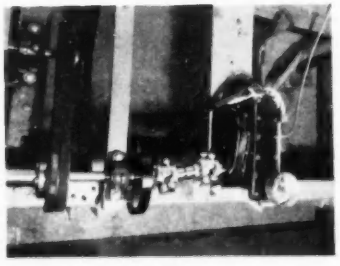

Fig. 4—Setup for testing endurance of engine timing gears.

AIA Forms Committee on Guided Missiles

The Aircraft Industries Association recently announced the establishment of a guided missile committee by the board of governors. The new committee, now being formed, will act in behalf of the guided missile manufacturers on collective problems regarding research, engineering design, development, construction, and testing of guided missiles. It also will coordinate industry action on mutual problems arising in the military services' requirements and procurement procedures for missiles.

Indicative of the strides being made in the guided missile field is the fact that the Air Force has earmarked an estimated $527 million for procurement obligations in fiscal 1954—an amount more than five times the obligations of over $97.4 million for fiscal 1952.

Steel Valve Tappets

(*Continued from page 37*)

used is a combusted gas with propane and ammonia added. The pieces are quenched in oil from a temperature of 1540 F, and develop a final hardness of Rc58. The crown then is finish honed and the stem finish ground, developing a surface of six microinches average roughness on the face of the tappet, and 12 microinches on the stem. A stress-relieving operation at 350 F for one hour does not reduce the hardness, but does help in reducing warpage. Tolerances on the finished valve tappet require that out-of-roundness and taper of the stem be held to less than 0.0003 in., that the face be square with the axis to within 0.001 in., and that a crown of 50-in. radius be developed on the head of the tappet.

The small socket in one end of the stem caused considerable trouble in the developmental stages of the process. When the socket was machined in, tool marks tended to mar the surface. By cold forming it in two steps, the first operation centers the blank and partially forms the socket, and the second step, performed with a highly polished pin, finishes the cavity accurately to size and contour and also produces a smooth finish. The piece also showed a tendency to crack at the thin wall of the socket, probably because of the shear cutoff that occurred there. Improved cutoff tools in the Boltmaker overcame this difficulty.

An additional refinement in the process now decided upon is the use of a Hogue wire drawing stand at the Boltmaker, so that hot rolled stock can be fed through the draw to reduce it in diameter, and the resulting cold drawn wire fed to the Boltmaker as at present. It has been estimated that the difference in mill price between hot drawn and cold drawn wire will more than offset the additional processing cost at the cold heading operation. As the wire will be headed within a few seconds after the cold drawing operation, no difficulty from age hardening of the steel because of the draw is anticipated.

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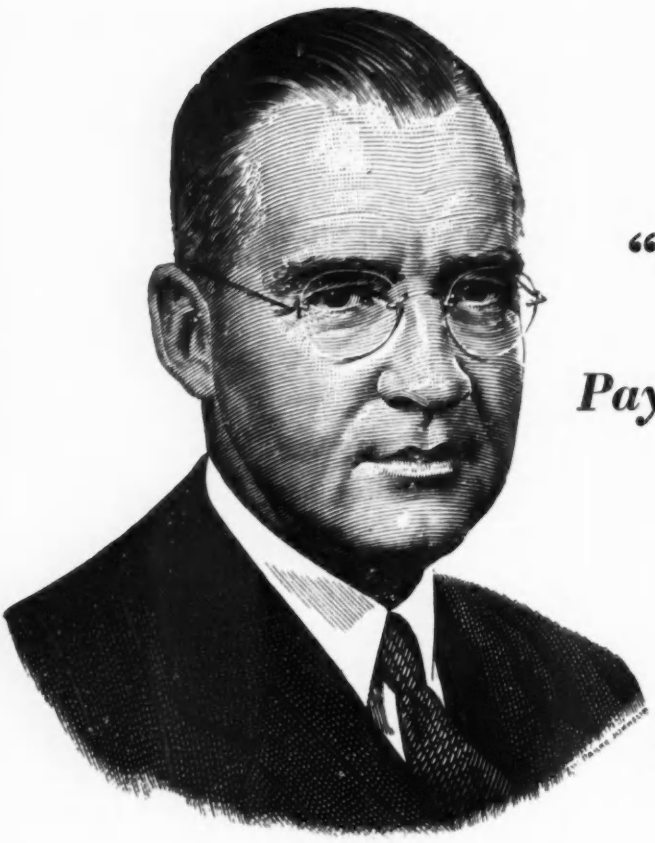

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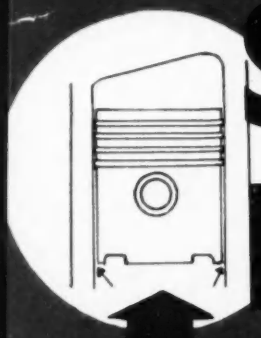

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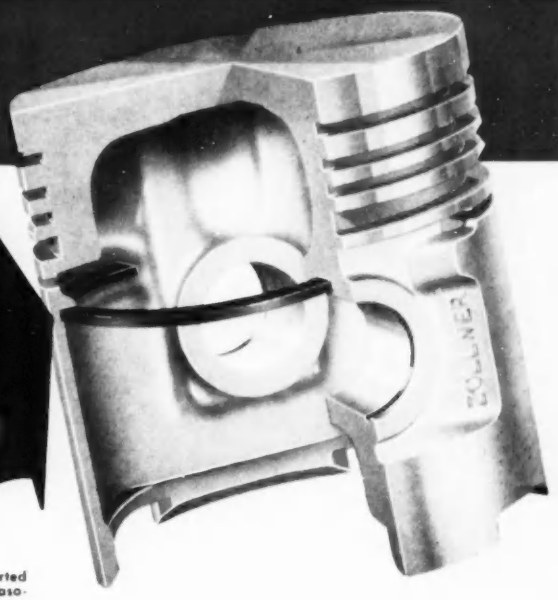

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